Final
Work Plan for
Groundwater Baseline Investigation at U.S. Navy's Eastern Maneuver Area Vieques Island, Puerto Rico

Prepared for

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command

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Prepared by

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Tampa, Florida

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Prepared for

United States Navy

Roosevelt Roads Naval Station

Ceiba, Puerto Rico

Contract No. N6247-95-D-6007

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Acronyms and Abbreviations

AFWTF	Atlantic Fleet Weapons Training Facility
ASTM	American Standard of Testing Materials
bls	Below Land Surface
BTEX	Benzene, Toluene, Ethylbenzene, and Total Xylenes
CFR	Code of Federal Regulations
COC	Chain-of-Custody
COPC	Constituent of Potential Concern
DOT	Department of Transportation
DQE	Data Quality Evaluation
DV	Data Validation
EMA	Eastern Maneuver Area
GPS	Global Positioning System
LANTDIV	Atlantic Division
NGVD	National Geodetic Vertical Datum
NSGA	Naval Securities Group Activity
ORS	Oil Recovery System
OVA	Organic Vapor Analyzer
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NATO	North Atlantic Treaty Organization
NSRR	U.S. Naval Station Roosevelt Roads
PHA	Portable Hydrocarbon Analyzer
PPM	Parts per Million
PRASA	Puerto Rico Aqueduct and Sewer Authority
PVC	Poly Vinyl Chloride
QA/QC	Quality Assurance/Quality Control
RFI	RCRA Facility Investigation
RCRA	Resource Conservation and Recovery Act
SC	Site Characterization
TM	Technical Memorandum
TPH	Total Petroleum Hydrocarbons
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VOA	Volatile Organic Aromatics

SECTION 1

Introduction

The U.S. Environmental Protection Agency (USEPA) and the Department of the Navy (the Navy) entered into an Administrative Order of Consent (Consent Order) on January 20, 2000 to address potential environmental contamination at the Atlantic Fleet Weapons Training Facility (AFWTF) and the Eastern Maneuver Area (EMA) on Vieques Island, Puerto Rico. For the purpose of this report these properties are considered the Naval Facility. As part of the Consent Order, the Navy is required to complete a groundwater baseline investigation along the western property boundary of the Navy Facility. The investigation is to be designed to establish groundwater baseline quality and regional groundwater flow patterns along the western perimeter of the Naval Facility and to determine whether activities at the Naval Facility have impacted the groundwater at the Western perimeter of the Facility. In addition, the Navy is required to perform a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) to fully determine the nature and extent of any releases of hazardous wastes, solid wastes, and/or hazardous constituents from or at the EMA and AFWTF. The Phase I RFI Work Plan has been submitted as a separate document.

Pursuant to Contract Number N62470-95-D-6007 and the Consent Order, CH2M HILL has been retained by the Navy to perform a groundwater baseline investigation at EMA. This investigation follows the initial hydrogeologic investigation which was completed in August 1999. The hydrogeologic investigation was developed as an independent study for the Navy. This Work Plan presents the procedures to be followed during the field investigations of the baseline investigation and the laboratory procedures for analysis of collected samples.

1.1 Site Background

1.1.1 Site Description

Vieques Island has a land area of approximately 33,000 acres and is located in the Caribbean Sea approximately seven miles southeast of Puerto Rico (Figure 1-1). The Navy's facility (Naval Facility) is located on the eastern one-third of Vieques Island. The facility includes the Atlantic Fleet Weapons Training Facility (AFWTF) comprising 3,600 acres, and the adjacent and wholly contiguous Eastern Maneuver Area (EMA) comprising 11,000 acres. Both are under the command of United States Naval Station Roosevelt Roads (NSRR). Camp Garcia is located in the southwestern part of the EMA.

The AFWTF, located on the far eastern tip of the island, provides facilities for naval gunfire support and air-to-ground ordnance delivery training for Atlantic Fleet ships, NATO ships, air wings, and smaller air units from other allied nations and the Puerto Rican National Guard. The Fleet Marine Force, Atlantic, conducts training for Marine amphibious units, battalion landing teams, and combat engineering units in the EMA. On occasion, Naval units of allied nations having a presence in the Caribbean and the Puerto Rican National

Guard also utilize the EMA. The training areas have been in continuous use since World War II when the Navy acquired title to the land.

1.1.2 Previous Investigations

During August 1999, a hydrogeologic investigation (Hydrogeologic Investigation) was completed at the Eastern Maneuver Area on Vieques Island. The results of the investigation are summarized in "The Results of The Hydrogeologic Investigation Vieques Island Puerto Rico" (Baker, 1999). This report was submitted to U.S. EPA on March 16, 2000. The intent of the groundwater investigation was twofold: 1) assess if explosive related compounds are present in groundwater at the property boundary; and 2) establish the flow direction of groundwater at the EMA western property boundary and assess if there is the potential for offsite migration of the compounds. To meet these goals, eleven groundwater monitoring wells were installed at the property line such that groundwater samples could be obtained for laboratory analysis. In addition, eight piezometers were installed at varying distances east of the property line and groundwater elevation measurements were collected to assess the groundwater flow direction. The locations of the monitoring wells and piezometers are presented on Figure 1-2. Four of the monitoring wells (RCRA-1, RCRA-2, RCRA-3, RCRA-4) were installed for the baseline investigation identified in the Consent Order. Well logs are presented in Appendix A.

The results of the hydrogeologic investigation concluded the following:

- Hydrogeologic data indicates groundwater flow in the bedrock is primarily to the north and south from the middle of the island. As a result, groundwater within bedrock is not likely to flow from Navy property to the west.
- Hydrogeologic data indicates groundwater flow in the alluvial deposits is primarily to the east. As a result, groundwater within the alluvial deposits is unlikely to flow from the Navy property to the west.
- No explosive related chemical compounds were detected in surface soil samples.
- No explosive related chemical compounds were detected in groundwater samples.
- The laboratory detection limits for the explosive related chemical compounds were all below the most conservative risk-based screening criteria. As a result, no Constituents of Potential Concern (COPCs) could be identified.
- No human health or ecological risk exists with regard to explosive compounds.

In addition to sampling the eleven wells along the western property boundary for explosive derived compounds, the Navy also sampled the eleven monitoring wells for metals to characterize the metal content of the groundwater along the western property boundary of the EMA. Groundwater in the four wells to be sampled under this work plan has previously been analyzed for all Appendix IX metal constituents. Metals results are presented in Appendix B.

During September 1999, EPA sampled the potable water supply and distribution tanks on the Island of Vieques, one potable water supply and distribution tank maintained by the

Navy, three wells at Sun Bay that are operated by Compania de Aguas and two private wells that were reported to supply water to the public during potable water service interruptions. The results of this sampling are presented in the report entitled "Sampling of the Río Blanco Filter Plant & Vieques Public Water Supply Tanks"(EPA, 2000), which is included as Appendix C.

1.1.3 Regional Hydrogeology

The approximately 10-square-mile Esperanza Valley is the largest alluvial valley in Vieques. The alluvial deposits extend from the vicinity of Ensenada Sombe to Tapon in Camp Garcia. This area likely has the greatest potential for ground-water development in Vieques. Until 1978, Puerto Rico Aqueduct and Sewer Authority (PRASA) operated a battery of 10 wells in the Valley. Groundwater withdrawals in the valley averaged about 425,000 gal/day. As pumpage increased with development of the well field, the salinity of the water increased.

Camp Garcia, located east of Esperanza Valley, includes about five square miles of the U.S. Navy controlled land on Vieques. Bedrock in the Camp Garcia area is predominantly unweathered, highly impermeable granodiorite; the porosity is very low, and the potential for groundwater development is limited. Toward the coast, clayey alluvium overlies the granodiorite. Samples from wells in the Camp Garcia area show mostly saline water in the clayey alluvium. Historical data collected by Anderson show that prior to the development of the well field in Esperanza Valley in 1945, ground-water levels in the Camp Garcia area were about 10 ft. below land surface (bls). From 1961 to 1965, declines from 2 to 20 ft. were recorded in three wells in the area. Well yields also declined from about 35 to 10 gal/min. (Torres-Gonzalez, 1989).

The maintenance of potable groundwater in Vieques island depends upon the quantity of water pumped and the location of wells. During the initial development stages of the Esperanza well field, ground-water quality was generally good, with chloride ion concentration seldom exceeding 100 mg/L. As uncontrolled development and pumpage proceeded, however, saline water intruded into the alluvial aquifers, with chloride concentration exceeding 200 mg/L.

Historical water-quality data from PRASA show the effects of saline water intrusion in the Esperanza alluvial aquifer. The chloride concentration at six of the wells increased from a background concentration of 100 mg/L to about 250 mg/L.

Water-quality data for Vieques indicate that in the Esperanza Valley, saline water intrusion occurred throughout most of the alluvial aquifer as a result of overpumpage and reduction of the thickness of the overlying freshwater lens. Proper groundwater management, initiated in 1977, has resulted in a nearly complete recovery of the aquifer to pre-developed conditions.

In spite of the observed improvements in the quality of the groundwater in Vieques, groundwater use may be limited for agricultural purposes (Torres-Gonzalez, 1989).

1.1.4 Site Hydrogeology

The geology at the Navy Facility on Vieques Island is characterized by volcanic and plutonic bedrock overlain by alluvial unconsolidated sediments and patches of limestone. The

volcanic bedrock consists primarily of andesites of Cretaceous age (Briggs and Akers, 1965). The plutonic bedrock consists largely of granodiorite and quartz-diorite that is exposed over a large percentage of the island. The alluvium consists of a mixture of sand, silt, and clay. The thickness of the unconsolidated layer decreases northward from wells NW-7 and NW-8 (Figure 1-3) located along the Caribbean shoreline to well NW-3, located at the highest elevation within the study area. Likewise, the thickness of the unconsolidated layer increases again northward from NW-3 toward NW-1 located near the Atlantic Ocean shoreline (Baker, 1999).

As part of the previous Hydrogeologic Investigation, groundwater elevation measurements were recorded on August 26, 1999 and are presented in Figure 1-3. The depth to groundwater within the bedrock ranged from approximately 36 feet at NW-5 to 131 feet at P-1. The groundwater elevations of the bedrock are significantly higher than the elevations where groundwater was encountered during drilling. This would indicate that the bedrock formation is under artesian conditions. The groundwater elevation data for the bedrock indicates that a groundwater flow divide exists within the bedrock at the approximate north/south mid point of the island: at the location of well NW-3 (see Figure 1-3). Generally, groundwater north of well NW-3 flows north toward the Atlantic Ocean and groundwater south of NW-3 flows south toward the Caribbean Sea.

During the Hydrogeologic Investigation groundwater investigation, it was determined that a municipal landfill is potentially located upgradient from monitoring well RCRA-1.

1.2 Project Objectives

In accordance with the Consent Order, the Navy will submit to USEPA the results of the "baseline" groundwater investigation along the western perimeter of the Navy Facility in a Groundwater Investigation Report. The baseline groundwater investigation shall be designed to “establish baseline groundwater quality, regional groundwater flow patterns along the western perimeter of the Navy Facility, and to determine whether activities at the Navy’s Facility have impacted groundwater at the western perimeter of the Facility; and if such impacts are indicated, are they currently, or in the future, likely to migrate offsite into the non-Navy owned areas of Vieques Island” The baseline investigation is to include the sampling of the four wells shown on Figure 1-2 as monitoring wells RCRA-1, RCRA-2, RCRA-3 and RCRA-4.

The specific objectives of the baseline groundwater investigation are to:

- Measure groundwater elevations from the eleven groundwater monitoring wells and eight piezometers previously installed along the western property boundary of the EMA to delineate the direction(s) of groundwater flowing onto and off of the Eastern Maneuver Area.
- Sample the four monitoring wells (RCRA-1, RCRA-2, RCRA-3, RCRA-4) requested by EPA in the Consent Order and analyze the samples for RCRA Appendix IX constituents to assess if site-related constituents are present in the groundwater and potentially migrating offsite.

- Evaluate the data from the investigation to assess whether activities at the Navy's EMA have impacted groundwater at the western perimeter of the EMA; and if such impacts are indicated, are they currently, or in the future, likely to migrate offsite into the non-Navy owned areas of Vieques Island.
- Evaluate the data from the investigation to assess if there is a potential for groundwater to flow from offsite sources of contamination onto the Navy property.

The groundwater baseline investigation is to supplement the initial hydrogeologic investigation completed in November 1999 because the initial investigation did not include all the compounds listed in Appendix IX.

SECTION 2

Technical Approach and Investigation Procedures

This section details the technical approach developed to perform the proposed Groundwater Baseline Investigation sampling activities. The goal of the sampling effort is to collect representative groundwater samples to make a recommendation for additional action or no further action based on the data interpretation. The tasks included in the technical approach are listed below. The remainder of this section provides detailed discussions of the investigation procedures.

- Task 1: Project Planning
- Task 2: Field Investigation
- Task 3: Sample Analysis and Validation
- Task 4: Data Evaluation

2.1 Task 1: Project Planning

This task consists of the preparation of Project Plans associated with the Groundwater Baseline Investigation.

2.1.1 Work Plan

The Final Master Work Plan for AFWTF (CH2M HILL, February 2001) will be used for guidance on the activities to be performed for this investigation. The Master Work Plan includes the Master Project Plan, Master Sampling and Analysis Plan (SAP), and Master Health and Safety Plan (HASP). The Master SAP consists of three documents: the Master Field Sampling Plan (FSP), the Master Quality Assurance Project Plan (QAPP), and the Master Investigation-Derived Waste Management Plan (IDWMP). The Master Plans provide the approach to be used for investigations, and general types of activities to be accomplished.

This site-specific work plan supplements the Master Plan and will present site-specific information where sampling activities are proposed. The HASP, FSP, QAPP, and IDWMP are presented as checklists of items based on the existing Master Work Plans (including other supporting documentation, and additions/deviations from the Master Plan), and are submitted within this document, as Appendix D.

2.1.2 Meetings

During the course of the investigations and report development, meetings will be held to discuss the proposed project schedule and findings with LANTDIV, PREQB, EPA, and

NSRR. CH2M HILL will provide minutes of the meetings to LANTDIV and NSRR. One site visit was performed during work plan preparation.

2.1.3 Project Management

The activities involved in project management include daily technical support and guidance, budget and schedule review and tracking, preparation and review of invoices, personnel resources planning and allocation, subcontractor coordination, preparation of monthly progress reports, and communication and coordination of events with LANTDIV, PREQB, EPA, and NSRR.

2.2 Task 2: Groundwater Sampling

This groundwater baseline investigation will involve sampling four (4) wells (RCRA-1, RCRA-2, RCRA-3, RCRA-4) that were previously installed during the Hydrogeologic Investigation completed in August 1999 (Baker, 1999). Groundwater samples collected from the four wells will be analyzed for all constituents included in Appendix IX of 40 C.F.R. Part 264, excluding all metals. Groundwater in the four wells to be sampled as part of this workplan have previously been sampled for all Appendix IX metals, as discussed in Section 1.1. TCLP analyses may be required for investigation derived waste (IDW) characterization to determine the appropriate disposal method.

2.2.1 Groundwater Sampling Procedures

Prior to performing groundwater sampling, depth to groundwater will be obtained using an electronic water level probe. The water level will be measured to the nearest 0.01 foot from the top of the polyvinyl chloride (PVC) well casing.

Purging activities will be conducted in a manner which minimizes agitation of groundwater in the wells, and at a rate not to exceed one liter per minute. Purging will be conducted using low flow peristaltic pumps when the depth to water will allow the use of these pumps. Peristaltic pumps, however, can only pull water from a depth of approximately 25 feet. Therefore, in instances where groundwater is greater than approximately 25 feet below grade, variable speed submersible environmental pumps (Grundfos or equivalent) will be utilized for purging. Bladder pumps were ruled out for use at ATWTF for purging because of the difficulty in obtaining compressed gasses on the island. All down-hole and effluent tubing will be Teflon® lined or Teflon®.

Groundwater samples will be collected from the discharge hose of the purge pump into properly-labeled, laboratory-prepared sampling containers filled and/or preserved as appropriate; cooled to approximately 4 °C; and shipped to the analytical laboratory under appropriate COC documentation procedures. The pump rate shall be slowed to less than one liter per minute, relative to purging, for all samples to reduce the potential for collecting turbid groundwater samples. Care will be taken to avoid degassing during sampling. Clean double check valve bailers may be used for sampling as a last resort in wells in which the depth to water or other extenuating circumstances preclude the collection of non-turbid samples through the pump. In this case, care will be taken when lowering the bailer not to agitate the water surface. Table 2-1 presents the required containers, preservatives, and holding times for groundwater samples.

TABLE 2-1
Required Containers, Preservatives, and Holding Times for Water Samples

Analysis	Methodology	No. of Containers	Sample Container	Preservative	Holding Time	Volume of Sample Collected
VOCs	SW-846 Method 5030B/8260B	3	Three 40-ml glass vials w/Teflon-lined cap	HCl to pH <2; Cool to 4ºC	14 days	Fill completely; no air bubbles
SVOCs	SW-846 Method 3510C/8270C	2	Two 1-liter bottles	Cool to 4ºC	7 days extraction/40 days to analysis	Fill to shoulder
Pesticides/ PCBs	SW-846 Methods 3510C/8081A and 3510C/8082	2	Two 1-liter bottles	Cool to 4ºC	7 days/ extraction/40 days to analysis	Fill to shoulder
Total Organic Carbon	EPA Method 9060	1	500-ml amber glass	H_2SO_4 or HNO_3 to pH<2; Cool to 4oC	28 Days	Fill completely, no air bubbles
TCLP VOCs	SW-1311/3010A/3020 A/8260B	3	40-ml glass vials w/Teflon-lined cap	Cool to 4ºC HCL to pH<2	14 days to filter/14 days to analysis	Fill completely; no air bubbles
TCLP SVOCs, Pesticides, Metals	SW-1311 SW-3510C/ 8270C/8081A SW-3010A/6010B SW-7470A for mercury	2	1-liter bottles	Cool to 4ºC	14 days to filter/40 days to SVOC and Pest analysis; 28 days to mercury analysis; 180 days to metals analysis	Fill to shoulder
Total Suspended Solids (TSS)	EPA Method 160.2	1	500 mL bottle	Cool to 4ºC	7 days	Fill to shoulder
Total dissolved Solids (TDS)	EPA Method 160.1	1	250 ml bottle	Cool to 4ºC	7 days	Fill to shoulder
Alkalinity	EPA Method 310.1	1	250 ml bottle	Cool to 4ºC	14 days	Fill to shoulder
Hardness	EPA Method130.2	1	250 ml bottle	HNO_3 to pH <2; Cool to 4ºC	6 months	Fill to shoulder

2.2.2 Sampling Equipment Decontamination

All non-disposable sampling equipment will be decontaminated immediately after each use. The applicable SOPs for the decontamination of personnel and equipment from Volume 2 of the Master Project Plan are included with the FSP checklist.

2.2.3 Sample Designation

Sampling locations and samples collected during the investigation will be assigned unique designations to allow the sampling information and analytical data to be entered into the existing Geographic Information System (GIS) Data Management system. The existing designation scheme for AFWTF and EMA will be followed by field personnel. The following sections describe the sample designation specifications.

2.2.3.1 Specifications for Field Location Data

Field station data is information assigned to a physical location in the field at which some sort of sample is collected. For example, a soil boring that has been installed will require a name that will uniquely identify it with respect to other soil boring locations, or other types of sampling locations. The station name provides for a key in the database to which any samples collected from that location can be linked, to form a relational database.

A listing of the location identification numbers will be maintained by the field team leader, who will be responsible for enforcing the use of the standardized numbering system during all field activities. Each station will be designated by an alphanumeric code that will identify the station's location by facility, site type, site number, station type, and sequential station number. The scheme that will be used to identify field station data is documented in Table 2-2.

2.2.3.2 Specifications for Analytical Data

Analytical data will be generated through sampling of various media at AFWTF and EMA. Each analytical sample collected will be assigned a unique sample identifier. The scheme used as a guide for labeling analytical samples in the field is documented below. The format that will be used for electronic deliverables from the analytical laboratory and the data validator is documented below.

2.2.3.3 Sample Identification Scheme

A standardized numbering system will be used to identify all samples collected during water, soil, and sediment sampling activities. The numbering system will provide a tracking procedure to ensure accurate data retrieval of all samples taken. A listing of the sample identification numbers will be maintained by the field team leader, who will be responsible for enforcing the use of the standardized numbering system during all sampling activities. Sample identification for all samples collected during the investigations will use the following format.

Each sample will be designated by an alphanumeric code that will identify the facility, site, matrix sampled, and contain a sequential sample number. QA/QC samples will have a

TABLE 2-2
Field Station Scheme

First Segment	Second Segment	
Facility, Station Type, Site Number	**Station Type**	**Station Number, Qualifier**
AAANNN	**AA**	**NNNA**
Facility: CG = Camp Garcia, AFWTF, EMA Station Type: S = Site W = SWMU O = Operable Unit U = UST A = AOC Site Number: RCRA-1=RCRA-1 Well RCRA-2=RCRA-2 Well RCRA-3= RCRA-3 Well RCRA-4= RCRA 4 Well	Station Type: SB = Subsurface Soil Sample Location SD = Sediment Sample Location SS = Surface Soil Sample Location SW = Surface Water Sample Location GW = Groundwater Sample Location Station Number: Sequential Station Number Qualifier: S = Shallow D = Deep K = Background	

Notes:
"A" = alphabetic
"N" = numeric

unique sample designation. The general guide for sample identification is documented in Table 2-3. If one qualifier is pertinent to the sample identification (ID) but another is not, only the Table 2-2 applicable qualifiers will be used. A non-utilized character space does not have to be maintained.

2.2.3.4 Electronic Deliverable File Format

An offsite laboratory will analyze the groundwater baseline investigation samples and tabulate the results in an electronic format specified by CH2M HILL. The data validator will add data validation qualifiers to the table of analytical results. In addition to hard copy data package deliverable, CH2M HILL will receive an electronic file from the data validator in a table format that will facilitate downloading into a database. The format that will be used for electronic deliverables is tabulated in Table 2-4.

2.2.3.5 Surveying

Locations of each well have been horizontally located using a global positioning system (GPS) following field activities. Elevations of monitoring wells have been surveyed to an accuracy of ± 0.01 feet. All survey data will be tied in to the facility coordinate system.

2.3 Task 3: Sample Analysis and Validation

This task involves efforts related to the sample management and data validation. CH2M HILL will be responsible for tracking sample analysis and obtaining results from the laboratory. The analytical data generated during the SWMUs investigation field program will be validated by an independent data validation subcontractor according to EPA's *National Functional Guidelines for Organic Data Review* (EPA, 1999).

2.3.1 Sample Analysis

All analyses of soil and groundwater will be conducted at a contracted laboratory that fulfills all requirements of the U.S. Navy's QA/QC Program Manual and EPA's Contract Laboratory Program (CLP) and SW 846 (for methods not covered by CLP). The laboratory must follow the scope of work prepared by the project team. A signed certificate of analysis will be provided with each laboratory data package, along with a certificate of compliance certifying that all work was performed in accordance with the EPA SOW. All analyses will be performed following the highest level of EPA guidance. Analyses will include the proper ratio of field QC samples recommended by EPA guidance for the DQOs.

This task includes checking the data from the laboratory and converting it into an electronic format that can be readily incorporated into the GIS Data Management system for the AFWTF and EMA.

2.3.1.1 Field Quality Control Procedures

Quality control duplicate samples and blanks are used to provide a measure of the internal consistency of the samples and to provide an estimate of the components of variance and the bias in the analytical process. The QAPP provides details with regard to the number and frequency of field QC samples to be collected during the investigation.

TABLE 2-3
Sample Designation Scheme

First Segment	Second Segment		Third Segment
Facility, Station, and Site Number	**Sample Type**	**Sample Location + Sample Qualifier**	**Additional Qualifiers (sample depth, sampling round, etc.)**
AAANN	**AA**	**NNNA or NNAA**	**ANN or NNNN**
Facility: CG= Camp Garcia, AFWTF, EMA Station Type: S = Site W = SWMU O = Operable Unit U = UST A = AOC Site Number: RCRA-1=RCRA-1 Well RCRA-2=RCRA-2 Well RCRA-3= RCRA-3 Well RCRA-4= RCRA 4 WelL	Sample Type: DS = Direct Push – Soil DW = Direct Push – Water SD = Sediment SS = Surface Soil TB = Trip Blank EB = Equipment Blank FB = Field Blank FD = Field Duplicate Sample Location: 1. Station Samples (NNA) NNA – refers to sequential station number NNA – letter qualifier for Deep, Shallow, or Composite, sample (if applicable). 2. QC Samples (NNN) NNN – numbered sequentially for each type of blank (i.e., 1, 2, etc.) collected for that day's sampling NNN – refers to month of sampling event Sample Qualifiers: F = filtered sample P = duplicate sample K = background sample	Additional Qualifiers: 1. Monitoring Well Groundwater Sample (refers to sampling round for that well): R01 - Round 1 R02 - Round 2 R03 - Round 3 2. Direct Push Subsurface Sample (refers to depth of sample): Enter depth of top of sample interval 3. QC Samples NNNN - refers to day and year of sampling event

Notes:
"A" = alphabetic
"N" = numeric

TABLE 2-4
Analytical Data Electronic Deliverable

Analytical data must be delivered in a format compatible with Microsoft Access 2.0 or 7.0

Field Name	Field Type	Description
Sample_ID	A20	The CH2M HILL sample ID (taken from the Chain of Custody)
Sample_Analysis	A5	The analysis performed on the sample. We classify our samples into six main groups: VOA, SVOA, INORG, PEST, WCHEM, and FMETAL (for filtered samples).
Date_Analyzed	D	The date the sample was analyzed.
Date_Received	D	The date the sample was received in the lab.
Date_Collected	D	The date the sample was collected.
Lab_Sample_ID	A15	The lab sample ID.
Dilution_Factor	N	The dilution factor used, if applicable.
SDG_Number	A6	The SDG number.
CAS_Number	A6-A2-A1	CAS Number of the compound being analyzed (Note that the CAS number must consist of three number segments of defined length, separated by dashes).
Chem_Name	A50	The compound being analyzed.
Ana_Value	N	The analytical result.
Std_Qual	A5	The lab qualifiers, if any (e.g., U, UJ, B)
DV_Qual	A5	The data validation qualifier (e.g., J, R)
Units	A10	The unit of the result (e.g., MG/L)
Detect_Limit	N	The detection limit for the compound.
Method	A15	Analytical method used to analyze the sample fraction.

2.3.1.2 Blanks

Blanks provide a measure of cross-contamination sources, decontamination efficiency, and other potential errors that can be introduced from sources other than the sample. American Society for Testing and Materials (ASTM) Type II water will be used for blanks. Four types of blanks can be generated during sampling activities: trip blanks, field blanks, equipment rinsate blanks, and temperature blanks.

One trip blank will be included in each cooler used for the daily shipment of VOC samples. If more than one cooler is being sent on a given day, all of the VOC samples should be placed in one cooler, if possible, to minimize the number of trip blanks needed. The trip blanks will be prepared before each sampling event, shipped or transported to the field with the sampling bottles, and returned unopened for analysis. Trip blanks will indicate if there is contamination during shipment to the field, from storage in the field, or from shipment from the field to the analytical laboratory.

One field blank will be collected per sampling event. If sampling events extend beyond one week (five working days) or for windy and dusty field conditions, the number of field blanks should be increased. Field blanks are used to determine the chemical quality of water used for such procedures as decontamination and blank collection.

One equipment blank per sample medium will be obtained for each day of sampling. Equipment blanks will give an indication of the efficiency of decontamination procedures.

EPA has recently requested that a temperature blank be included in each cooler containing samples for analyses so that the laboratory can record the temperature without disturbing the samples. The temperature blank will be labeled, but will not be given a sample number nor will be listed as a sample on the COC form.

2.3.1.3 Duplicates

Field duplicate samples will be collected at a frequency of 1 field duplicate per 10 field samples per matrix. The locations from which the duplicates are taken will be selected randomly. Each duplicate sample will be split evenly into two sample containers and submitted for analysis as two independent samples.

2.3.1.4 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected at a frequency of 1 MS/MSB for every 20 field samples collected. Analytical results of these samples indicate the impact of the matrix (water, soil, sediment) on extracting the analyte for analysis. MS/MSD samples give an indication of the laboratory's analytical accuracy and precision within the sample matrix. Data validators will use these results to evaluate the accuracy of the analytical data.

2.3.2 Data Validation

Analytical results from the proposed sampling, as well as the existing Appendix IX metal results, will be validated by CH2M HILL subcontractors approved by the Navy. Data validators will use EPA Region II guidance (*National Functional Guidelines for Organic Data Review*, 1999).

The hardcopy data packages will be reviewed by the subcontractor chemists using the process outlined in EPA's *Functional Guidelines for Evaluating Data* (EPA, 1999). Areas of review included (when applicable to the method) holding time compliance, calibration verification, blank results, matrix spike precision and accuracy, method accuracy as demonstrated by laboratory confirmation samples (LCSs), field duplicate results, surrogate recoveries, internal standard performance, and interference checks. A data review worksheet will be completed for each of these data packages and any non-conformance will be documented. This data review and validation process is independent of the laboratory's checks and focuses on the usability of the data to support the project data interpretation and decision-making processes.

Data that are not within the acceptance limits will be appended with a qualifying flag, which consists of a single or double-letter abbreviation that reflects a problem with the data. The following flags will be used in the evaluation:

U - Undetected. Analyte was analyzed for but not detected above the method detection limit.

UJ - Detection limit estimated. Analyte was analyzed for, and qualified as not detected. The result is estimated.

J - Estimated. The analyte was present, but the reported value may not be accurate or precise.

R - Rejected. The data are unusable. (NOTE: Analyte/compound may or may not be present.)

Numerical sample results that are greater than the method detection limit (MDL) but less than the laboratory reporting limit (RL) are qualified with a "J" for estimated as required by EPA's *Functional Guidelines* (EPA, 1994).

2.4 Task 4: Data Quality Evaluation

Analytical data will be collected during this investigation in the form of laboratory analytical results and the database will be populated with data validation qualifier results.

The data quality evaluation (DQE) is the quantitative and qualitative evaluation of overall trends in the project-specific database. The objective of the DQE process is to understand the effects of the overall analytical process on data usability to support project-specific data quality objectives (DQOs). The DQE includes an analysis of the effect of the specific sample matrix on the overall analytical process.

The DQE deliverable is a DQE technical memorandum (TM) that can be used by the project team to readily understand project-specific data usability. Topics to be addressed in the DQE TM include the following:

- *Potential blank contamination*—the effect on the usability of data for compounds detected in both the field or laboratory blank samples and the corresponding field samples
- *Laboratory performance*—evaluation of the recovery for blank spike samples such as the LCS, calibration criteria, etc.

- *Potential matrix interferences*—evaluation of the accuracy and precision for surrogates, spiked field samples, and duplicate field sample results
- *Assessment of PARCCs*—comparison of data validation (DV) findings with PARCCs (precision, accuracy, representativeness, comparability, and completeness)

This task also includes the evaluation of validated laboratory data and field-generated data. The data evaluation will include incorporation of historical data from the previous investigations, tabulation of the data, and generation of figures and/or tables associated with data (e.g., sampling location maps).

All analytical requirements and laboratory deliverables necessary for evaluation of the validity of data gathered will be provided as part of the validation package submitted with the draft and final reports. These requirements will include a comparison of the analytical data to data quality objectives, the implementation of EPA Region 2 data validation SOPs, and a review of the raw analytical data.

SECTION 3

Groundwater Baseline Investigation Report

The Groundwater Baseline Investigation Report will include the following items:

1. Introduction

1.1 Site Description

1.2 Summary of Previous Investigations

2. Field Investigation Activities

2.1 Sample Locations (number and type of samples, sampling strategy)

2.2 Sampling Methods (sampling procedures, analytical methods)

2.3 Data Validation (including 1999 inorganic results)

3. Summary of Investigation Results

3.1 Assessment of Groundwater Flow Conditions

3.2 Analytical Data Summary

3.3 Comparison to Human Health Risk Assessment Screening Levels

EPA Region IX Tap Water Preliminary Remediation Goals (PRGs) concentrations, or the maximum contaminant levels (MCLs) given at 40 C.F.R. Part 141 Subpart B, whichever are lower, will be utilized for screening groundwater results to evaluate if there are potential unacceptable threats to human health and whether further investigations are warranted. Tables will be incorporated to present analytical results that exceed selected screening values.

Data validation results from the analytical data in Appendix B (1999 inorganic results) will be provided in the Draft Groundwater Baseline Investigation Report.

SECTION 4

Project Schedule

This section documents the project schedule and duration time of deliverables. Table 4-1 provides a breakdown on primary deliverables and assumed intervals for governmental review. Longer periods of review will result in an extended schedule.

TABLE 4-1
Groundwater Baseline Investigation at U.S. Navy's Eastern Maneuver Area
AFTWF, Vieques Island, Puerto Rico, 2000

Key Project Milestones	Milestone Duration
Draft Groundwater Baseline Investigation Work Plan	30 days
EPA Review	90 days
Final Groundwater Baseline Investigation Work Plan	75 days
EPA Approval of Final Work Plan	30 days
Begin Implementation of Work Plan	60 days
Conduct Field Investigation	30 days
Laboratory Analyses	30 days
Data Validation/Management	30 days
Data Evaluation	30 days
Draft Baseline Groundwater Quality Report	30 days
EPA Review	90 days
Final Baseline Groundwater Quality Report	75 days

SECTION 5

References

Baker, 1995. Final RCRA Facility Investigation, Naval Station Roosevelt Roads, Puerto Rico, September 14, 1995.

Baker Environmental Inc., 1999. Results of the Hydrogeologic Investigation Vieques Island, Puerto Rico. November 1999.

Briggs, R. P., and J.P. Akers, Hydrogeologic Map of Puerto Rico And Adjacent Islands U.S. Geological Survey Hydrologic Investigations Atlas HA-1965.

CH2M HILL, Inc. and Baker Environmental Inc. Draft Work Plan Hydrogeologic Investigation U.S. Navy Facility Vieques, Puerto Rico. August 1999.

CH2M HILL Inc. Final Master Work Plan Atlantic Fleet Weapons Training Facility, Vieques Island, Puerto Rico. February 2001.

Gonzalez, S.T., Reconnaissance of the Groundwater Resources of Vieques Island, Puerto Rico U.S. Geological Survey Water Resources Investigations Report 86-4100.

U.S. Environmental Protection Agency, Region IX Preliminary Remediation Goal (PRG) concentration screening values.

U.S. Environmental Protection Agency, Sampling of the Rio Blanco Filter Plant & Vieques Public Water Supply Tanks.

Maximum Contaminant Levels, 40 CFR Part 141, Subpart B.

APPENDIX A

Well Logs of RCRA Wells

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Vieques Phase I, Vieques Island, Puerto Rico
CTO NO.: 138
BORING NO.: RCRA-1
COORDINATES: EAST:
NORTH:
ELEVATION: SURFACE:
TOP OF PVC CASING:

Rig: CME-55	Split Spoon	Casing	Augers	Core Barrel
Size (ID)	1 5/8		4 1/4	
Length	2		5	
Type			STD	
Hammer Wt.			130	
Fall			30	

Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
8/13/99	65.0'bgs		--

Remarks:

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch 40 PVC screen			
Sch 40 PVC riser			

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) BG/PS	Visual Description	Well Installation Detail	Elevation (Ft. MSL.)
1–10	R-N					Moderately weathered, 5/6 10yr yellowish brown, granodiorite look alike material, matrix olive-green (olivine material) oxide material on faces of fragments		

DRILLING CO.: SoilTech
DRILLER: Osvaldo
BAKER REP.: Joe Morales
BORING NO.: RCRA-1

TEST BORING AND WELL CONSTRUCTION RECORD

Baker Environmental

PROJECT: Vieques Phase I, Vieques Island, Puerto Rico
CTO NO.: 138 BORING NO.: RCRA-1

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BG/PS = Background/Point Source

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) BG/PS	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
31								
32								
33								
34								
35	R-N					Same as above		
36								
37								
38								
39								
40								
41								
42								
43								
44							cement/	
45	R-N					Same as above	grout to surface	
46								
47							Bentonite	
48								
49								
50							gravel to bottom	

DRILLING CO.: SoilTech BAKER REP.: Joe Morales
DRILLER: Osvaldo BORING NO.: RCRA-1 SHEET 3 OF 4

INSUFFICIENT DATA SET FOR RCRA-2

TEST BORING AND WELL CONSTRUCTION RECORD

Baker Environmental

PROJECT: Vieques Phase I, Vieques Island, Puerto Rico
CTO NO.: 138
BORING NO.: RCRA-3
COORDINATES: EAST:
NORTH:
ELEVATION: SURFACE:
TOP OF PVC CASING: 153.937

Rig: CME-55	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 5/8		4 1/4		8/6/99	69.0'bgs.		--
Length	2		5					
Type			STD					
Hammer Wt.			130					
Fall			30					

Remarks:

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch 40 PVC screen			
Sch 40 PVC riser			

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) BG/PS	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1-5	A-N					Brown-Red Sandy cuttings, dry		
6-7	S-1	1.5/2.0 75%	10 9 9 9			Brown-Red Sand with dense upper interval, loose lower interval, sedimentary throughout dry, no odor		
8-10	A-N							
	S-2		9			Match to Sheet 2		

DRILLING CO.: SoilTech
DRILLER: Osvaldo
BAKER REP.: Matt Maloney
BORING NO.: RCRA-3

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Vieques Phase I, Vieques Island, Puerto Rico
CTO NO.: 138 BORING NO.: RCRA-3

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BG/PS = Background/Point Source

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) BG/PS	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
31						Continued from Sheet 2	cement/ grout	
32								
33	R-N							
34								
35						medium to coarse cuttings, **Granodiorite** composition, quartz and feldspar		
36								
37								
38								
39								
40								
41								
42								
43								
44								
45						**Same as above**, except with pyrite, more whites, less fines		
46								
47								
48							bentonite	
49								
50						darker because of oxide material more brown in rock frags		

DRILLING CO.: SoilTech BAKER REP.: Matt Maloney
DRILLER: Osvaldo BORING NO.: RCRA-3 SHEET 3 OF 4

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Vieques Phase I, Vieques Island, Puerto Rico
CTO NO.: 138
BORING NO.: RCRA-4
COORDINATES: EAST:
NORTH:
ELEVATION: SURFACE:
TOP OF PVC CASING:

Rig: CME-55	Split Spoon	Casing	Augers	Core Barrel	Date	Progress (Ft.)	Weather	Depth to Water (Ft.)
Size (ID)	1 5/8		4 1/4		8/7/99	35.5'bgs		--
Length	2		5					
Type			STD					
Hammer Wt.			130					
Fall			30					

Remarks:

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston
N = No Sample

WELL INFORMATION

Type	Diam.	Top Depth (Ft.)	Bottom Depth (Ft.)
Sch 40 PVC screen			
Sch 40 PVC riser			

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) BG/PS	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
1-5	A-N					yellowish brown dry sand, fine o medium		
6-7	S-1	2.0/2.0 100%	10 10 15 18			Clayey Sand, yellowish 4/6 5yr, organic material on top		
8-10	A-N					Same as above		
	S-2		11					

DRILLING CO.: SoilTech
DRILLER: Osvaldo
BAKER REP.: Joe Etheridge
BORING NO.: RCRA-4

Baker Environmental

TEST BORING AND WELL CONSTRUCTION RECORD

PROJECT: Vieques Phase I, Vieques Island, Puerto Rico
CTO NO.: 138 BORING NO.: RCRA-4

SAMPLE TYPE
S = Split Spoon A = Auger
T = Shelby Tube W = Wash
R = Air Rotary C = Core
D = Denison P = Piston N = No Sample

DEFINITIONS
SPT = Standard Penetration Test (ASTM D1586)
PID = Photo Ionization Detector Measurement
MSL = Mean Sea Level
BG/PS = Background/Point Source

Depth (Ft.)	Sample Type & No.	Sample Rec. (Ft.,%)	SPT	Lab ID	PID (ppm) BG/PS	Visual Description	Well Installation Detail	Elevation (Ft. MSL)
31	S-6	75%	33 50/5"			sand, white, no dark minerals	bentonite	
32						(granodiorite look alike)		
33	A-N					weathered, decomposed black minerals and some quartz from 31.5' to 35'		
34								
35								
36	S-7	50%	7/8 50/2			decomposed rock, Silty Sand, some silty clay, same as 30-32' moist: light greenish grey silty fine sand, some black material		
37								
38	A-N					pale yellow cuttings, fine silt, like powder	gravel to bottom	
39								
40							top of screen	
41	S-8	30%	50/3			Silty Sand, wet at bottom 2" fragments of decomposed rock like granodiorite, some clay in the matrix, fine to medium sand		
42								
43	A-N					some wet cuttings		
44								
45								
46	S-9	25%	50/5			wet, clayey sand, same as above but wet		
47								
48	A-N							
49							bottom of screen	
50								
						boring terminated @ 50.0'bgs		

DRILLING CO.: SoilTech BAKER REP.: Joe Etheridge
DRILLER: Osvaldo BORING NO.: RCRA-4 SHEET 3 OF 3

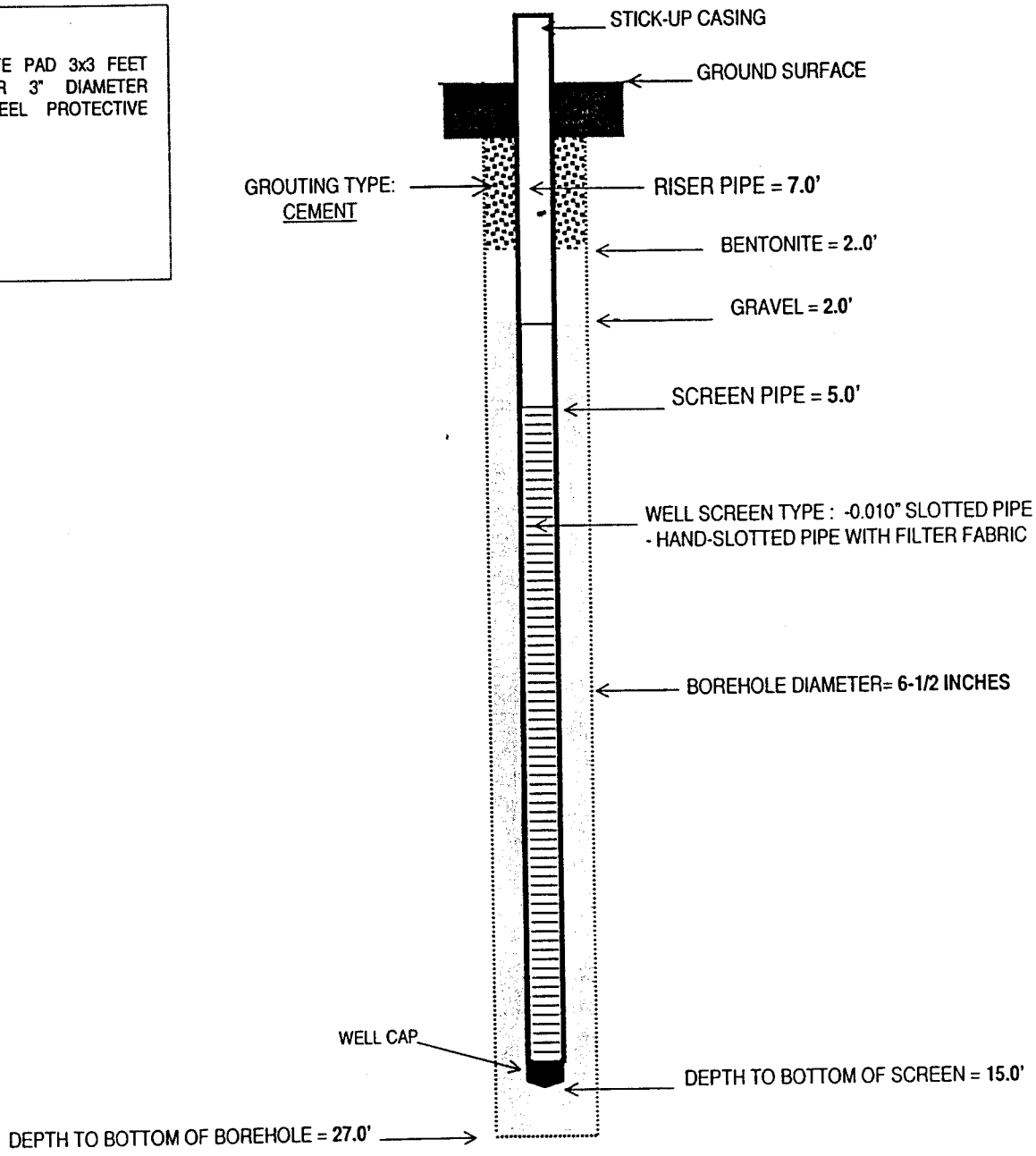
ERTEC

WELL CONSTRUCTION DETAIL

PROJECT NAME:	CAMP GARCIA	WELL ID:	NW-8
LOCATION	VIEQUES, PUERTO RICO	BEGIN DATE:	08/03/99
CLIENT:	CH2M-HILL	FINISH DATE:	08/03/99
JOB NO.:	E-990716	WELL PURPOSE:	MONITORING WELL
FIELD PERSON:	MATT	DRILLER:	SOIL TECH DRILLING
MANHOLE TYPE:	__ FLUSH GROUND	MEASURE BASE AT:	_X_ GROUND LEVEL
	_X_ ABOVE GROUND		____ MEAN SEA LEVEL
UNIT:	_X_ FEET __ METER	WELL DIAMETER:	2 INCHES

NOTES:

- CONCRETE PAD 3x3 FEET AND FOUR 3" DIAMETER BLANK STEEL PROTECTIVE PIPE.



ERTEC

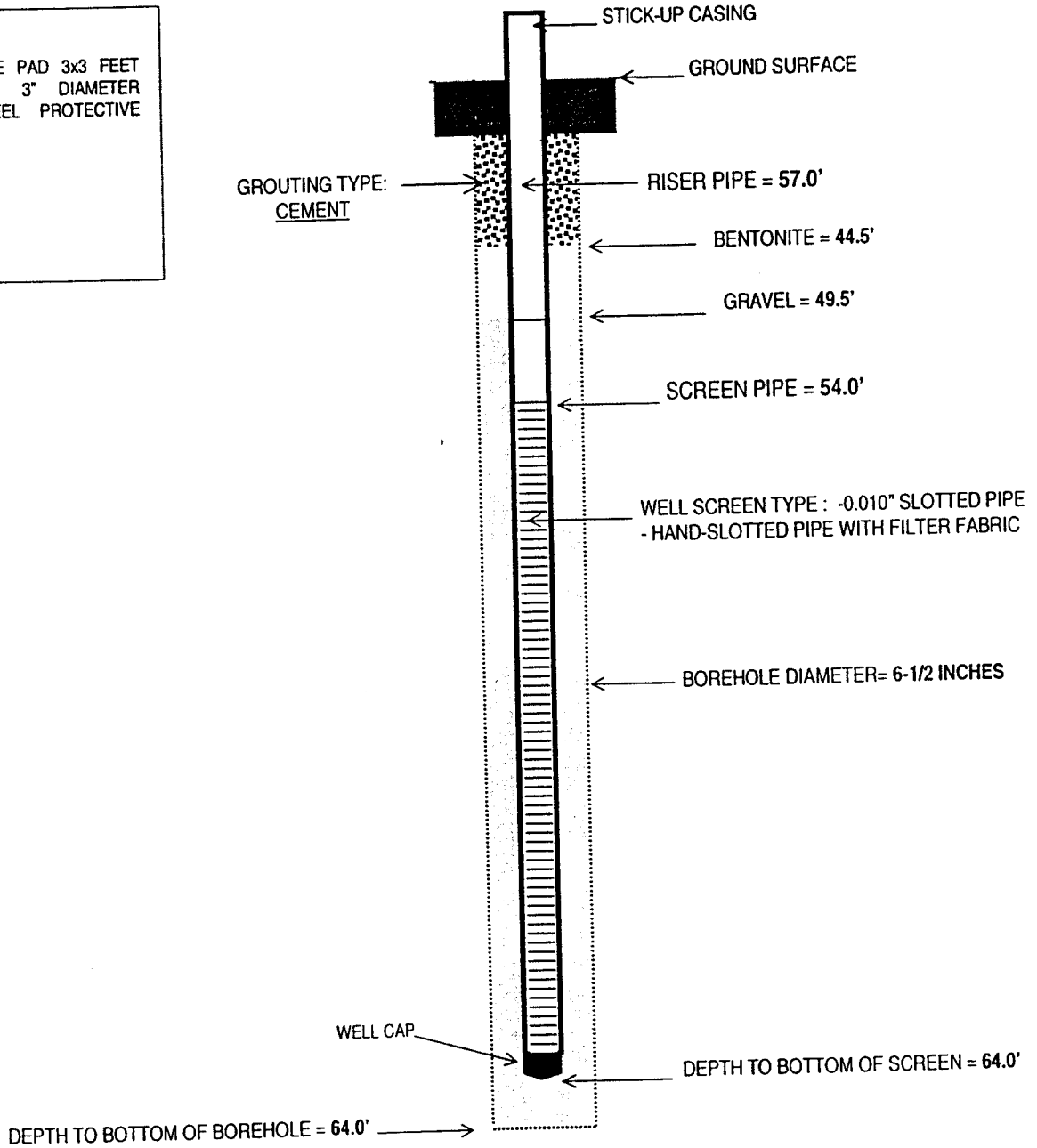
WELL CONSTRUCTION DETAIL

PROJECT NAME:	CAMP GARCIA
LOCATION	VIEQUES, PUERTO RICO
CLIENT:	CH2M-HILL
JOB NO.:	E-990716
FIELD PERSON:	MATT
MANHOLE TYPE:	__ FLUSH GROUND
	X ABOVE GROUND
UNIT:	X FEET __ METER

WELL ID:	RCRA-2
BEGIN DATE:	08/08/99
FINISH DATE:	08/08/99
WELL PURPOSE:	MONITORING WELL
DRILLER:	PERFORACIONES E.CAMPOS
MEASURE BASE AT:	X GROUND LEVEL
	MEAN SEA LEVEL
WELL DIAMETER:	2 INCHES

NOTES:

- CONCRETE PAD 3x3 FEET AND FOUR 3" DIAMETER BLANK STEEL PROTECTIVE PIPE.



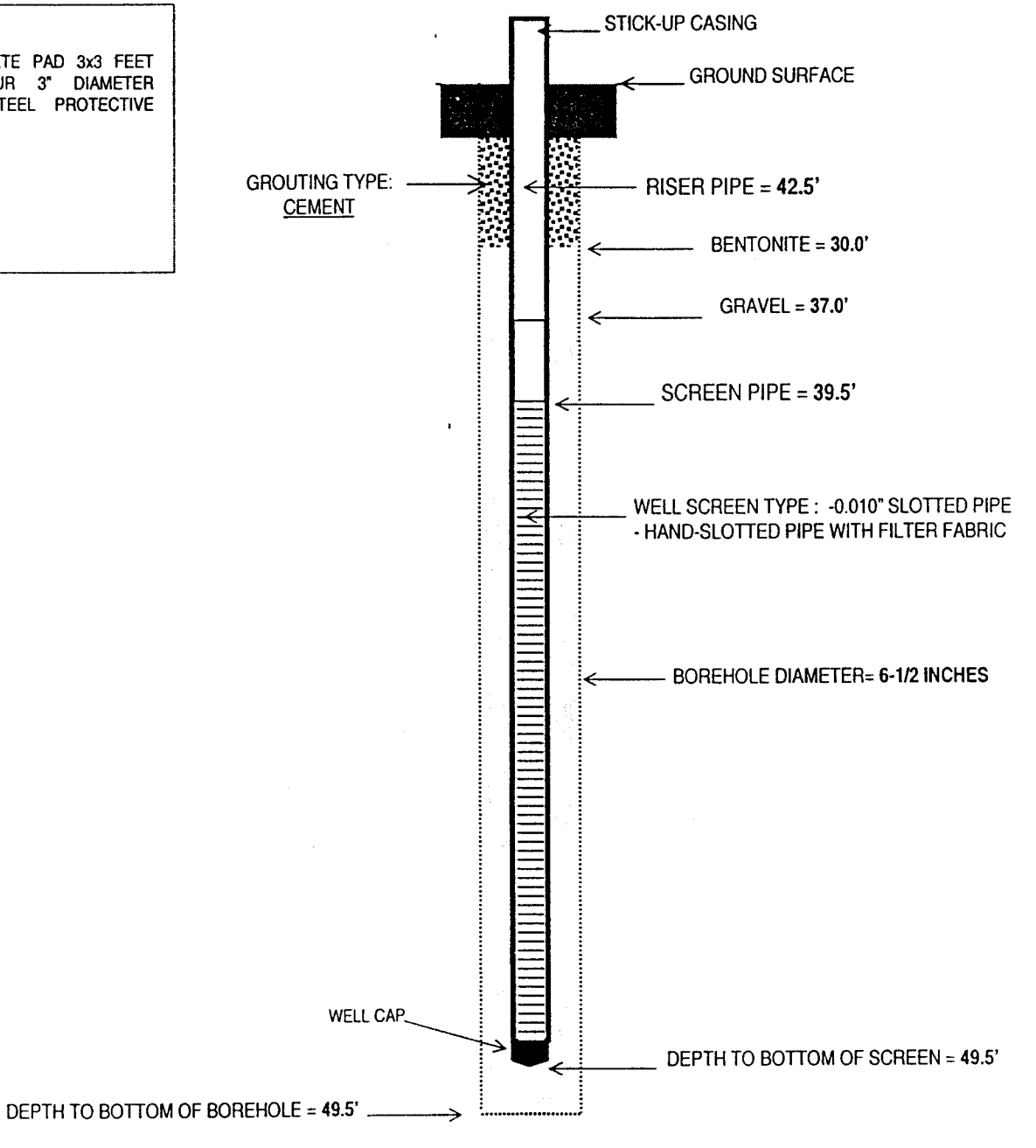
ERTEC

WELL CONSTRUCTION DETAIL

PROJECT NAME:	CAMP GARCIA	**WELL ID:**	**RCRA-4**
LOCATION	VIEQUES, PUERTO RICO	**BEGIN DATE:**	08/11/99
CLIENT:	CH2M-HILL	**FINISH DATE:**	08/11/99
JOB NO.:	E-990716	**WELL PURPOSE:**	MONITORING WELL
FIELD PERSON:	JOEL MORALES	**DRILLER:**	SOILTECH DRILLING
MANHOLE TYPE:	__ FLUSH GROUND	**MEASURE BASE AT:**	_X_ GROUND LEVEL
	_X_ ABOVE GROUND		____ MEAN SEA LEVEL
UNIT:	_X_ FEET __ METER	**WELL DIAMETER:**	2 INCHES

NOTES:

- CONCRETE PAD 3x3 FEET AND FOUR 3" DIAMETER BLANK STEEL PROTECTIVE PIPE.



APPENDIX B

Inorganic Data from Monitoring Wells

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS
GROUNDWATER
VIEQUES ISLAND

SAMPLE ID	NAVY-1-GW	NAVY-3-GW	NAVY-4-GW	NAVY-5-GW	NAVY-6-GW	NAVY-7-GW	NAVY-8-GW	RCRA-1-GW
LOG NUMBER	S915651-1	S915608-12	S915651-3	S915556B-29	S915556B-30	S915651-2	S915608-11	S915556B-6
SAMPLE DATE	08/20/99	08/19/99	08/20/99	08/18/99	08/18/99	08/20/99	08/19/99	08/18/99
TOTAL METALS (mg/l)								
Antimony	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Arsenic	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0043 B	0.01 U
Barium	0.054	0.02	0.058	0.1	0.039	0.5	0.36	0.018
Beryllium	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.00011 B	0.004 U
Cadmium	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.002 B	0.005 U
Chromium	0.0041 B	0.0047 B	0.012	0.0044 B	0.00089 B	0.0032 B	0.054	0.01 U
Cobalt	0.0057 B	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.024	0.01 U
Copper	0.024	0.014 B	0.0025 B	0.0062 B	0.0039 B	0.0039 B	0.2	0.0013 B
Lead	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U
Mercury	0.0002 UN	0.0002 UN	0.0002 UN	0.0002 U	0.0002 U	0.0002 UN	0.0002 UN	0.0002 U
Nickel	0.0073 B	0.0098 B	0.0011 B	0.015 B	0.0026 B	0.0013 B	0.033 B	0.04 U
Selenium	0.0034 B	0.01 U	0.01 U	0.0063 B	0.01 U	0.01 U	0.0051 B	0.01 U
Silver	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Thallium	0.002 UN	0.002 UWM	0.002 UN	0.002 UW	0.002 U	0.002 UWN	*0.01 U	0.002 UW
Tin	0.0019 B	0.01 U	0.01 U	0.0028 B	0.01 U	0.01 U	0.0075 B	0.01 U
Vanadium	0.021	0.02	0.011	0.01 U	0.0075 B	0.0074 B	0.14	0.0022 B
Zinc	0.027	0.015 B	0.021	0.013 B	0.018 B	0.028	0.46	0.031

NOTES: B = Not detected substantially above the level reported in laboratory or field blank
U = Not detected. The associated number indicates approximate sample concentration necessary to be detect
W = Post digestion spike for furnance AA analysis is out of control limits (85-115%
while sample absorbance is less than 50% of spike absorbanc
N = Tentative identification. Consider present. Special methods may be needed to confirm its presence or absence in future sampling eff
M = Duplicate injection precision not met
* = ICP detection leve

mg/l = milligrams per liter

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS
GROUNDWATER
VIEQUES ISLAND

SAMPLE ID	RCRA-2-GW	RCRA-2-GWD	RCRA-3-GW	RCRA-4-GW
LOG NUMBER	S915556B-7	S915556B-8	S915556B-9	S915608-8
SAMPLE DATE	08/18/99	08/18/99	08/18/99	08/19/99
TOTAL METALS (mg/l)				
Antimony	0.02 U	0.02 U	0.02 U	0.02 U
Arsenic	0.01 U	0.01 U	0.01 U	0.01 U
Barium	0.033	0.03	0.32	0.14
Beryllium	0.004 U	0.004 U	0.004 U	0.004 U
Cadmium	0.005 U	0.005 U	0.005 U	0.005 U
Chromium	0.01 U	0.01 U	0.01 U	0.0014 B
Cobalt	0.01 U	0.01 U	0.01 U	0.01 U
Copper	0.0014 B	0.0011 B	0.0011 B	0.0032 B
Lead	0.005 U	0.005 U	0.005 U	0.005 U
Mercury	0.0002 U	0.0002 U	0.0002 U	0.0002 UN
Nickel	0.04 U	0.04 U	0.04 U	0.0019 B
Selenium	0.01 U	0.0057 B	0.01 U	0.01 U
Silver	0.01 U	0.01 U	0.01 U	0.01 U
Thallium	0.002 UW	0.002 UW	0.002 U	0.002 U
Tin	0.01 U	0.01 U	0.01 U	0.01 U
Vanadium	0.012	0.012	0.0037 B	0.0075 B
Zinc	0.026	0.022	0.16 B	0.078

NOTES: B = Not detected substantially above the level reported in laboratory or field blank
U = Not detected. The associated number indicates approximate sample concentration necessary to be detect
W = Post digestion spike for furnance AA analysis is out of control limits (85-115%
while sample absorbance is less than 50% of spike absorbanc
N = Tentative identification. Consider present. Special methods may be needed to confirm its presence or absence in future sampling eff

mg/l = milligrams per liter

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS
SURFACE SOIL
VIEQUES ISLAND

SAMPLE ID	NAVY-1-SS	NAVY-3-SS	NAVY-3-SSD	NAVY-4-SS	NAVY-5-SS	NAVY-6-SS	NAVY-7-SS	NAVY-8-SS	RCRA-1-SS	RCRA-2-SS
SAMPLE DATE	08/16/99	08/16/99	08/16/99	08/17/99	08/16/99	08/16/99	08/17/99	08/17/99	08/16/99	08/16/99
TOTAL METALS (mg/kg dw)										
Antimony	0.63 BN	0.68 BN	0.99 BN	0.76 BN	2.2 UN	0.75 BN	0.6 BN	0.46 BN	0.73 BN	0.91 BN
Arsenic	0.54 B	2.5	2.3	3.5	1.1	0.98 U	1.3 U	0.74 B	0.95 B	1.8
Barium	44	110	100	140	160	63	71	99	83	110
Beryllium	0.29 B	0.24 B	0.23 B	0.35 B	0.26 B	0.19 B	0.14 B	0.23 B	0.36 B	0.31 B
Cadmium	0.52 U	0.55 U	0.5 U	0.53 U	0.55 U	0.49 U	0.63 U	0.53 U	0.48 U	0.54 U
Chromium	13	24	22	23	9	3	3.1	5.2	17	15
Cobalt	17	20	18	21	10	4.8	3.7	6.5	20	20
Copper	21	120	93	42	36	39	15	23	36	70
Lead	2.3	1.1	1.2	2.1	1.5	4.1	2.2	3.3	1.4	1.1
Mercury	0.017 B	0.0055 U	0.0046 U	0.0081 B	0.0065 B	0.018 B	0.0053 U	0.011 B	0.014 B	0.011 B
Nickel	10	14	14	13	6.9	1.5 B	1.8 B	3.4 B	12	11
Selenium	1 U	1.1 U	1 U	1.1 U	1.1 U	0.98 U	1.3 U	1.1 U	0.96 U	1.1 U
Silver	1 U	1.1 U	1 U	1.1 U	1.1 U	0.98 U	1.3 U	1.1 U	0.96 U	1.1 U
Thallium	1 U	1.1 U	1 U	1.1 U	1.1 U	0.98 U	1.3 U	1.1 U	0.96 U	1.1 U
Tin	2.1 B	2.2 B	2.8 B	2.1 B	1.9 B	2.4 B	2.6 B	2.5 B	2.8 B	2.9 B
Vanadium	62	110	89	89	71	36	26	43	120	100
Zinc	51	51	43	19	17	22	11	19	38	33

NOTES: B = Not detected substantially above the level reported in laboratory or field blank
N = Tentative identification. Consider present. Special methods may be needed to confirm its presence or absence in future sampling eff
U = Not detected. The associated number indicates approximate sample concentration necessary to be detect

mg/kg = milligrams per kilogram.
dw = dry weight

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS
SURFACE SOIL
VIEQUES ISLAND

SAMPLE ID	RCRA-3-SS	RCRA-4-SS	SS-01	SS-02	SS-03	SS-04	SS-05	SS-06	SS-06D	SS-07	SS-08	SS-09
SAMPLE DATE	08/16/99	08/16/99	08/18/99	08/18/99	08/18/99	08/18/99	08/18/99	08/18/99	08/18/99	08/18/99	08/18/99	08/18/99
TOTAL METALS (mg/kg dw)												
Antimony	1.1 BN	0.61 BN	0.86 BN	0.48 BN	0.53 BN	0.77 BN	0.44 BN	0.57 BN	2.1 UN	1.9 UN	0.61 BN	0.65
Arsenic	1.2	0.51 B	2	1.2	1.4	0.86 B	0.63 B	0.52 B	1.1 U	0.95 U	0.74 B	1
Barium	140	140	130	56	77	63	96	76	83	47	36	36
Beryllium	0.23 B	0.25 B	0.33 B	0.33 B	0.32 B	0.33 B	0.37 B	0.31 B	0.31 B	0.29 B	0.34 B	0.29
Cadmium	0.57 U	0.53 U	0.049 B	0.52 U	0.52 U	0.54 U	0.53 U	0.52 U	0.53 U	0.47 U	0.52 U	0.47
Chromium	7	5.1	21 N	34 N	29 N	50 N	43	81 N	84 N	34	21	27
Cobalt	11	8.3	19	21	23	27	24	31	30	30	15	19
Copper	35	28	75 N	84 N	59 N	110 N	52	86 N	67 N	610	140	35
Lead	1.9	3.1	6.9	3	3.5	1.9	2.6	1.6	1.8	1.1	2.2	2.7
Mercury	0.013 B	0.013 B	0.035	0.045	0.11	0.016 B	0.024	0.016 B	0.013 B	0.008 B	0.005 B	0.01
Nickel	4.3 B	3.2 B	18	21	21	37	27	54	52	40	13	16
Selenium	1.1 U	1.1 U	0.95 U	2.1	1 U	1.1 U	0.61 B	1 U	1.1 U	0.95 U	1 B	0.94
Silver	1.1 U	1.1 U	0.95 U	1 U	1 U	1.1 U	1.1 U	1 U	1.1 U	0.95 U	1 U	0.94
Thallium	1.1 U	1.1 U	0.95 U	1 U	1 U	1.1 U	1.1 U	1 U	1.1 U	0.95 U	1 U	0.94
Tin	2.6 B	2.3 B	1.8 B	2.6 B	2.9 B	2.5 B	2.6 B	2.5 B	3 B	2 B	1.8 B	2
Vanadium	54	43	61	83	75	85	71	97	93	96	110	73
Zinc	23	20	190	190	100	64	67	59	57	70	70	85

NOTES: B = Not detected substantially above the level reported in laboratory or field blank
N = Tentative identification. Consider present. Special methods may be needed to confirm its presence or absence in future sampling eff
U = Not detected. The associated number indicates approximate sample concentration necessary to be detect

mg/kg = milligrams per kilogram.
dw = dry weight

B = Not dete
N = Tentativ
U = Not dete

mg/kg = mil
dw = dry we

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS
SURFACE SOIL
VIEQUES ISLAND

SAMPLE ID		SS-10	SS-11	SS-12	SS-13	SS-14	SS-15	SS-16	SS-16-FD	SS-17	SS-18	SS-19
SAMPLE DATE		08/18/99	08/18/99	08/18/99	08/18/99	08/18/99	08/18/99	08/18/99	08/18/99	08/18/99	08/18/99	08/18/99
TOTAL METALS (mg/kg dw)												
Antimony	BN	0.61 BN	0.61 BN	1.9 UN	0.74 BN	0.74 BN	0.44 BN	0.75 BN	2.2 UN	0.92 BN	0.47 BN	0.54 BN
Arsenic		0.39 B	0.73 B	0.82 B	1 U	0.86 B	0.69 B	0.53 B	0.51 B	0.55 B	0.62 B	0.57 B
Barium		30	31	68	60	59	160	93	90	60	100	60
Beryllium	B	0.3 B	0.3 B	0.28 B	0.31 B	0.35 B	0.38 B	0.4 B	0.35 B	0.25 B	0.28 B	0.22 B
Cadmium	U	0.52 U	0.47 U	0.47 U	0.52 U	0.1 B	0.38 B	0.72 U	0.54 U	0.56 U	0.49 U	0.52 U
Chromium		18	9.8	18	14	23 N	16 N	17 N	16 N	13 N	24 N	26 N
Cobalt		24	18	20	24	25	46	26	20	18	20	18
Copper		17	24	43	50	56 N	130 N	46 N	58 N	67 N	66 N	70 N
Lead		1.3	1.9	2.2	2.9	2.7	2.5	1.7	1.6	1	1.2	0.83
Mercury	B	0.018 B	0.017 B	0.064	0.015 B	0.018 B	0.0094 B	0.011 B	0.013 B	0.013 B	0.017 B	0.0052 U
Nickel		14	8.5	12	11	18	16	13	11	9	12	15
Selenium	U	0.78 B	0.54 B	0.95 U	1 U	0.89 B	1.1 U	1.4 U	1.1 U	1.1 U	0.98 U	0.54 B
Silver	U	1 U	0.94 U	0.95 U	1 U	1.1 U	1.1 U	1.4 U	1.1 U	1.1 U	0.98 U	1 U
Thallium	U	1 U	0.94 U	0.95 U	1 U	1.1 U	1.1 U	1.4 U	1.1 U	1.1 U	0.98 U	1 U
Tin	B	2.5 B	2.4 B	2.6 B	2 B	3.2 B	2.7 B	3.1 B	2.7 B	3.5 B	2.8 B	2.6 B
Vanadium		68	67	90	81	100	110	130	120	110	120	97
Zinc		61	55	79	96	130	200	93	94	67	37	39

NOTES: cted substantially above the level reported in laboratory or field blank
e identification. Consider present. Special methods may be needed to confirm its presence or absence in future sampling eff
cted. The associated number indicates approximate sample concentration necessary to be detect

igrams per kilogram.
ight

B = Not detected subs
N = Tentative identifi
U = Not detected. Th

mg/kg = milligrams p
dw = dry weight

ANALYTICAL SUMMARY OF INORGANIC CONSTITUENTS
SURFACE SOIL
VIEQUES ISLAND

SAMPLE ID	SS-20	SS-20-FD	SS-21
SAMPLE DATE	08/18/99	08/18/99	08/18/99
TOTAL METALS (mg/kg dw)			
Antimony	0.76 BN	0.72 BN	0.94 BN
Arsenic	1.1 U	0.34 B	1.1 U
Barium	99	92	47
Beryllium	0.29 B	0.28 B	0.2 B
Cadmium	0.54 U	0.48 U	0.57 U
Chromium	12 N	9.4 N	40 N
Cobalt	17	15	19
Copper	51 N	44 N	62 N
Lead	1.1	1	0.85
Mercury	0.013 B	0.011 B	0.009 B
Nickel	8.2	6.5	31
Selenium	1.1 U	0.97 U	1.1 U
Silver	1.1 U	0.97 U	1.1 U
Thallium	1.1 U	0.97 U	1.1 U
Tin	3.2 B	2.7 B	2.7 B
Vanadium	97	91	90
Zinc	47	45	36

NOTES: tantially above the level reported in laboratory or field blank
:ation. Consider present. Special methods may be needed to confirm its presence or absence in future sampling eff
: associated number indicates approximate sample concentration necessary to be detect

:r kilogram.

APPENDIX C

EPA Water Supply Study

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

JUN 29 2000

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Christopher T. Penny
Navy Technical Representative
Installation Restoration Section (South)
Environmental Program Branch
Environmental Division,
Atlantic Division (LANTDIV), Code 182
Naval Facilities Engineering Command
1510 Gilbert Street
Norfolk, VA 23511-2699

Dear Chris:

Enclosed please find the following documents, which are provided to the Navy pursuant to your verbal requests in connection with activities associated with the Atlantic Fleet Weapons Training Facility RCRA 3008(h) Consent Order:

1. EPA Region 2 report on January 18-19, 2000 "Sampling of the Rio Blanco Filter Plant & Vieques Public Water Supply Tanks [and private wells]".

2. EPA Region 2 report on September 27-28, 1999 "Vieques Puerto Rico Potable Water Storage Tanks and Well Sampling Report".

3. EPA Region 2 memo dated December 8, 1999 on "Amendment to the Vieques Sampling Report", from Dore LaPosta to Bruce Kiselica.

4. EPA Region 2 memo dated January 21, 2000 on "Revised Vieques Report", from Kevin W. Kubik to Dore LaPosta.

5. Copy of "Community Involvement Plans" dated 10/15/98, taken from EPA's "Superfund Community Involvement Handbook & Tool Kit", dated 12/15/98.

Please note, that because of privacy issues, the names of certain private wells have been blacked-out in the reports listed under item 1 and 2. Please telephone Mr. Tim Gordon of my staff at (212) 637- 4167 if you have questions regarding any of the above.

Sincerely yours,

Timothy Gordon, for

Nicoletta DiForte
Chief, Caribbean Section
RCRA Programs Branch

Enclosures (5)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II

DATE: 21 JAN 2000

SUBJECT: Revised Vieques Report

FROM: Kevin W. Kubik, Chief
Laboratory Branch

TO: Dore LaPosta, Chief
Monitoring and Assessment Branch

Attached please find the revised Vieques laboratory analytical report. Please note that Bis(2-ethylhexyl) Phthalate has been removed since those exceedences are most likely due to contamination introduced during the collection and analysis of the samples.

Please let me know if you have an questions.

Attachment

RECEIVED
JAN 21 2000
MONITORING & ASSESSMENT
BRANCH - MAB

Enclosure for letter to Chris Penny

REGION II FORM 1320-1 (9/85)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION II

DATE: DEC 0 8 1999

SUBJECT: Amendment to the Vieques, Puerto Rico Sampling Report

FROM: Dore Laposta, Chief
Monitoring and Assessment Branch

TO: Bruce Kiselica, Chief
Drinking Water Section, 2-DEPP-WPB

September 27 and 28, 1999 was the sampling date.

In the original Vieques Potable Water Storage Tank and Well Sampling Report dated November 5, 1999, we stated that the data related to the constituents of military ordnance were preliminary. This is to inform you that based on the results of our validation of the data, that data should be discarded. The data validation revealed that the data related to the constituents of military ordnance are not useable.

We are in the process of exploring the possibility of re-sampling, and will keep you informed of the status of that endeavor.

cc: Barbara A. Finazzo (2-DESA)
Carl Soderberg (2-CEPD)
Jose Font (2-CEPD)
Nicoletta Diforte (2-DEPP-RPB)
Jorge Martinez (2-CEPD-EMB)
Mary Mears (2-CD-POB)
Michael Glogower (2-DESA-MAB)

Brue

SAMPLING OF THE RIO BLANCO FILTER PLANT & VIEQUES PUBLIC WATER SUPPLY TANKS

Rio Blanco Filter Plant
Naguabo, Puerto Rico
&
Potable Water Tanks
Island of Vieques

January 18-19, 2000

Participating Personnel:

U.S. Environmental Protection Agency
Michael Glogower, Life Scientist
Steve Hale, Environmental Protection Specialist
Jorge Martinez, Environmental Engineer
Cristina Maldonado, Environmental Scientist

Other Personnel
Gabriel Montalvo, Compañia de Aguas (Rio Blanco)
Wilberto Conde, Compañia de Aguas (Vieques)
Stacie Notine, Resident of Vieques

Report Prepared By:

Michael Glogower 3/21/00
Michael Glogower, Life Scientist
Monitoring Operations Section

Approved for the Director By:

Dore LaPosta, Chief
Monitoring & Assessment Branch

January 18 -19, 2000 - Sampling Report
Rio Blanco Filter Plant and Vieques, Puerto Rico

Background

In September 1999, the U.S. Environmental Protection Agency (EPA) sampled the potable water supply and distribution tanks on the Island of Vieques, Puerto Rico (see Figure 1), one potable water storage tank maintained by the US Navy, three wells at Sun Bay that are operated by Compañia de Aguas, and two private wells that were reported to supply water to the public during potable water service interruptions. The potable water supply and distribution tanks are owned by the Puerto Rico Aqueduct and Sewer Authority (PRASA), and are operated by personnel from the Compañia de Aguas. Potable water is supplied from the mainland of Puerto Rico (by Compañia de Aguas) to Vieques via a submarine pipeline which conveys treated water from the Rio Blanco filter plant (in Naguabo, Puerto Rico) to the Arcadia tank (in Vieques). The incoming water is chlorinated just before it reaches the Arcadia storage tank. Potable water from the Arcadia tank is pumped to all the other storage and distribution tanks on the island, and no additional treatment is provided to the potable water.

The purpose of that sampling survey was to determine the level of certain specified contaminants in the potable water supply and distribution tanks, the three Compañia de Aguas operated wells, and the private and public wells. Concerns have been raised by a number of parties regarding the potential for contamination of these sources of water from the residuals associated with the detonation of military ordnance, and the subsequent migration of elements and compounds associated with military ordnance into the water supply. In addition, samples were taken to determine the overall quality of the water from these sources.

The results from that September 27-28, 1999 sampling survey were reported in the ***Vieques, Puerto Rico Potable Water Storage and Well Sampling Report***, dated November 5, 1999. However, based on an evaluation of the data, the data for the residuals associated with the detonation of military ordnance was determined (by the EPA) to be unusable. Therefore, on January 18-19, 2000, the EPA returned to Puerto Rico and the Island of Vieques to re-sample the potable water supplies for residuals associated with the detonation of military ordnance. The three wells at Sun Bay would not be re-sampled because they had been closed by PRASA. The two private wells that were reported to supply water to the public during potable water service interruptions would be re-sampled. However, it was decided to perform additional sampling, which included sampling the raw water intake and the treated water at the Rio Blanco filter plant, and the intake to the Arcadia tank.

Sampling Activities

January 18, 2000 - The EPA sampling team consisting of Michael Glogower and Steve Hale (from Edison, New Jersey) and Jorge Martinez and Cristina Maldonado (from the Caribbean Environmental Protection Division) met with Gabriel Montalvo (Compañia de Aguas), and proceeded to the Rio Blanco water filtration plant in Naguabo, Puerto Rico. Samples were taken of the intake and the finished water for residuals associated with the detonation of military ordnance.

January 19, 2000 - The EPA sampling team consisting of Michael Glogower, Steve Hale and Cristina Maldonado met with Stacie Notine. Samples were taken from the Martineau well and from Peterson's well for residuals associated with the detonation of military ordnance and also for nitrate and nitrite nitrogen. The surface of the water in the Martineau well was about nine feet below the surface of the land, and there was a approximately 10 feet of water in the well. Peterson's well was a 27-inch by 23-inch well that was made of cinder blocks. The depth to water was 18-inches, and the well had about 10 feet of water in it.

Next, we met with Wilberto Conde, who is the Compañia de Aguas Engineer for the water facilities on the Island of Vieques. Samples were taken for residuals associated with the detonation of military ordnance from the Naval Ammunitions Support Detachment (NASD) tank, the Arcadia tank (where an intake sample was also taken), the Pilon tank, the Esperanza tank, the Martineau tank, the Florida 1 tank, the Florida 2 tank, the Los Chinos tank, the Destino tank, and the Liquillow tank. Sample taps were available only on the Arcadia tank and on the NASD tank. Samples from the remaining eight tanks were taken through access hatches that were located on top of each tank. Figure 2 shows the locations that were sampled, and Table 1, provides a listing of the analytical results from the samples that were taken at each location.

Findings and Conclusions

The Martineau well was determined to contain 0.5 mg/L of nitrate plus nitrite nitrogen, and the Peterson's well was determined to contain 1.7 mg/L of nitrate plus nitrite nitrogen. However, when the quality control data associated with these samples were reviewed, it was determined the results could be biased low (under estimated). Potential sources of nitrates include animal waste, runoff from fertilizers, leaching from septic tanks, and sewage.

No compounds associated with the detonation of military ordnance were reported at detectable levels in the samples collected from the drinking water storage tanks, the two private wells or the filtration plant in Naguabo. A contract laboratory was used to analyze these samples; EPA validated the data and determined the results were acceptable. The laboratory did report an anomaly in the results of one of the Quality Control data sets; EPA carefully reviewed these results and believes the presence of chlorine in the water could be interfering with the QC results. This has no affect on the determination that there are no detectable levels of compounds associated with military ordnances.

Table 1
Vieques, Puerto Rico
A Comparison of the Sampling Results

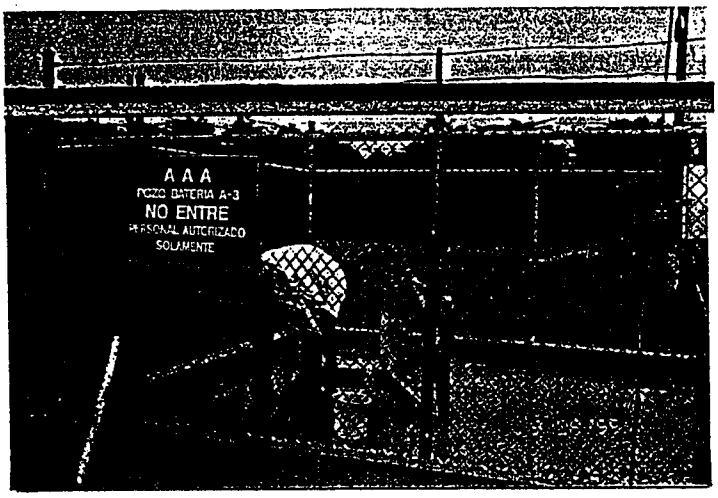
Parameter	Parameter (full name)	Rio Blanco Intake	Rio Blanco Output	NASD (Navy) Tank	Arcadia Tank (In)	Arcadia Tank (Out)
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	Undetected	Undetected	Undetected	Undetected	Undetected
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine	Undetected	Undetected	Undetected	Undetected	Undetected
1,3,5-TNB	1,3,5-Trinitrobenzene	Undetected	Undetected	Undetected	Undetected	Undetected
1,3-DNB	1,3- Dinitrobenzene	Undetected	Undetected	Undetected	Undetected	Undetected
Tetryl	Methyl-2,4,6-trinitrophenylnitramine	Undetected	Undetected	Undetected	Undetected	Undetected
NB	Nitrobenzene	Undetected	Undetected	Undetected	Undetected	Undetected
2,4,6-TNT	2,4,6-Trinitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
4-Am-DNT	4-Amino-2,6-dinitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
2,6Am-DNT	2-Amino-4,6-dinitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
2,4-DNT	2,4-Dinitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
2,6-DNT	2,6-Dinitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
2-NT	2-Nitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
3-NT	3-Nitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
4-NT	4-Nitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected

Table 1 (continued)
Vieques, Puerto Rico
A Comparison of the Sampling Results

Parameter	Parameter (full name)	Pilon Tank	Esperanza Tank	Martineau Tank	Florida 1 Tank	Florida 2 Tank
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	Undetected	Undetected	Undetected	Undetected	Undetected
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine	Undetected	Undetected	Undetected	Undetected	Undetected
1,3,5-TNB	1,3,5-Trinitrobenzene	Undetected	Undetected	Undetected	Undetected	Undetected
1,3-DNB	1,3- Dinitrobenzene	Undetected	Undetected	Undetected	Undetected	Undetected
Tetryl	Methyl-2,4,6-trinitrophenylnitramine	Undetected	Undetected	Undetected	Undetected	Undetected
NB	Nitrobenzene	Undetected	Undetected	Undetected	Undetected	Undetected
2,4,6-TNT	2,4,6-Trinitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
4-Am-DNT	4-Amino-2,6-dinitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
2,6Am-DNT	2-Amino-4,6-dinitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
2,4-DNT	2,4-Dinitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
2,6-DNT	2,6-Dinitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
2-NT	2-Nitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
3-NT	3-Nitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
4-NT	4-Nitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected

Table 1 (continued)
Vieques, Puerto Rico
A Comparison of the Sampling Results

Parameter	Parameter (full name)	Los Chinos Tank	Destino Tank	Leguillow Tank	Peterson's Well	Martineau Site Well
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	Undetected	Undetected	Undetected	Undetected	Undetected
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine	Undetected	Undetected	Undetected	Undetected	Undetected
1,3,5-TNB	1,3,5-Trinitrobenzene	Undetected	Undetected	Undetected	Undetected	Undetected
1,3-DNB	1,3- Dinitrobenzene	Undetected	Undetected	Undetected	Undetected	Undetected
Tetryl	Methyl-2,4,6-trinitrophenylnitramine	Undetected	Undetected	Undetected	Undetected	Undetected
NB	Nitrobenzene	Undetected	Undetected	Undetected	Undetected	Undetected
2,4,6-TNT	2,4,6-Trinitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
4-Am-DNT	4-Amino-2,6-dinitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
2-Am-DNT	2-Amino-4,6-dinitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
2,4-DNT	2,4-Dinitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
2,6-DNT	2,6-Dinitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
2-NT	2-Nitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
3-NT	3-Nitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected
4-NT	4-Nitrotoluene	Undetected	Undetected	Undetected	Undetected	Undetected



VIEQUES, PUERTO RICO
POTABLE WATER STORAGE TANK AND WELL SAMPLING REPORT

Vieques, Puerto Rico

September 27-28, 1999

Participating Personnel:

U.S. Environmental Protection Agency
Michael Glogower, Life Scientist
Steve Hale, Environmental Protection Specialist
Jorge Martinez, Environmetal Engineer

Compañia de Aguas
Wilberto Conde, Operations and Commercial Supervisor Office
Jose R. Guzman, Eastern Region Director
Ismael Martinez Jimenez, Director, Area de Laboratorios

Report Prepared By:

Michael Glogower 11/5/99
Michael Glogower, Life Scientist
Monitoring Operations Section

Approved for the Director By:

Dore LaPosta, Chief
Monitoring & Assessment Branch

Vieques, Puerto Rico
September 27-28, 1999 Sampling Report

Background

On September 27, 1999, an EPA sampling team that consisted of Michael Glogower and Steve Hale arrived in Vieques, Puerto Rico (see Figure - 1) in order to sample the potable water supply and distribution tanks operated by Compañia de Aguas (formerly PRASA), one potable water storage tank maintained by the US Navy, three wells at Sun Bay that are operated by Compañia de Aguas, and several private and public drinking water wells. The three Compañia de Aguas wells are occasionally used during emergency situations (such as after hurricanes), which results in the interruption of the public water supply from the mainland (which is by pipeline) to Vieques.

The purpose of the sampling was to determine the level of certain specified contaminants in the potable water supply and distribution tanks, the three Compañia de Aguas operated wells, and the private and public wells. Concerns have been raised by a number of parties regarding the potential for contamination of these sources of water from the residuals associated with the detonation of military ordnance, and the subsequent migration of elements and compounds associated with military ordnance into the water supply. In addition, samples were taken to determine the overall quality of the water from these sources. Potable water is supplied by Compañia de Aguas to Vieques via a submarine pipeline which conveys treated water from the Rio Blanco filter plant (in Naguabo, Puerto Rico) to the Arcadia tank (in Vieques). The incoming water is chlorinated just before it reaches the storage tank. Potable water from the Arcadia tank is pumped to all the other storage and distribution tanks on the island, and no additional treatment is provided to the potable water.

Sampling Activities

September 27, 1999 - The EPA sampling team met with Wilberto Conde (the Compañia de Aguas Engineer for the water facilities on the Island of Vieques) and Jorge Martinez (EPA - CEPD). We proceeded to the Arcadia tank where we took samples from the main distribution line which conveys potable water from the Arcadia tank (see Photos # 1 and 2) to the remaining tanks in the distribution system. Table 1 attached, shows the potable water storage and distribution tanks that were sampled, along with the free residual chlorine and pH determinations that were made on-site at each tank. A total of 10 potable water storage and/or distribution tanks was sampled. Sample taps were available only on the Arcadia tank and on the Naval Ammunitions Support Detachment (NASD) tank. Samples from the remaining eight tanks were taken through access hatches that were located on top of each tank (see Photos # 3 and 4). Tables 2 and 2-A, attached, provide a listing of the analytical results from the samples that were taken at each tank.

September 28, 1999 - EPA met with Wilberto Conde at Sun Bay, and we proceeded to measure the depth to water and the total depth each of the three wells located in that area. Well A-3 was determined to be 44.5 feet deep, and the depth to water was found to be 13.5 feet. Well A-2 was determined to be 42.0 feet deep, and the depth to water was found to be 14.25 feet. Well A-1

was determined to be 47.5 feet deep, and the depth to water was found to be 14.65 feet. Subsequently, the three 10-inch diameter wells were evacuated using a 2-inch pump with a rated pumping capacity of 37 gallons per minute. Each well took more than 30 minutes to evacuate a sufficient quantity of water in order for the well water to reach stability. Well water stability was determined when both the temperature and the pH of the water remained relatively constant. Then, the water level in each well was allowed to recover before the samples were taken. Each well was sampled with a clean bailer. Table 3, attached, provides a listing of the analytical results from the samples that were taken at each well.

After the wells were sampled, Jorge Martinez arranged for us to meet with Stacie Notine (a representative from a local environmental group), who showed us to the locations of private and public sources of water and wells. The first water source was a private well, known as the [redacted] which is located [redacted] in Barrio Puerto Real. We spoke to [redacted] who informed us that the well is used when there is a problem with the public water supply service. Also, other people come to use this water when potable water service is interrupted. However, the pump on the well was not functioning and therefore a sample could not be taken. Next, we went to an abandoned concrete structure that was known as the [redacted] well (see Photo # 5). Access to the site required passing through a barbed wire fence, and then traversing through 25 to 30 meters of dense vegetation. The water in the structure was sampled at 17:25 hours. We proceeded a short distance to the farm of [redacted] (also in Martineau). There was a large dug well on-site, which was used only for providing water to livestock. This well was not sampled because it was not being used as a water supply for humans. We also went to [redacted] well (see Photo # 6), which is located behind the home of [redacted] This site is located on the south side of Vieques, and is north of Mosquito Bay. This well has a cinder block structure enclosing it, and it is about 10 feet deep. [redacted] stated that people do use this well for drinking, and therefore it was sampled at 16:50 hours. Table 3, attached, provides a listing of the analytical results from the samples that were taken at each well.

While Ms. Notine was glad to see EPA actively involved in the environmental issues occurring in Vieques, she expressed concern over several other issues, including the contamination of ground water and ambient water. She was concerned that any contaminants in these waters might be accumulated in fish, shellfish and animals that are being used for food. She also expressed concern over the presence of munitions in many locations in the waters adjacent to the Island of Vieques.

Findings and Conclusions

The tables attached to this report reflect the contaminants that were found in the samples taken. Also attached to this report is the laboratory's Chemistry Case Narrative, which provides a discussion of the analyses conducted, and an interpretation and summary of the samples that contained levels above the MCL's or Secondary MCL's. This interpretation should not preclude a thorough review and comparison of the data with the MCL's by the EPA drinking water program staff.

The laboratory's chemistry narrative statement (attached) discusses several MCL or secondary MCL exceedences as follows:

Sanitary Chemistry Analytes:

MCL or SMCL Exceedences:

Sample 209538 (Peterson's well): Nitrate/Nitrite (12.6 mg/L;MCL=10 mg/L)

Sample 209537 (Sun Bay Well A-1): TDS (1670 mg/L;SMCL=500 mg/L)
Sample 209538 (Peterson's well): TDS (1330 mg/L;SMCL=500 mg/L)
Sample 209539 (Martineau well): TDS (1220 mg/L;SMCL = 500 mg/L)

Non-volatile organic compound:

Sample 209528 (Florida 2 tank): Bis (2-ethylhexyl) phthalate (10 ug/L; MCL = 6 ug/L)
Sample 209529 (Martineau tank): Bis (2-ethylhexyl) phthalate (15 ug/L; MCL = 6 ug/L)
Sample 209538 (Peterson's well): Bis (2-ethylhexyl) phthalate (22 ug/L; MCL = 6 ug/L)

However, the laboratory notes that - ***"The Bis (2-ethylhexyl) phthalate exceedences are most likely due to contamination of the sample introduced during the collection and analysis of the samples."***

Metals:

MCL/SMCL Exceedences:

Sample 209535 (Sun Bay Well A-3): Iron (1620 ug/L;SMCL=300 ug/L);
Manganese (115 ug/L;SMCL=50 ug/L)
Sample 209536 (Sun Bay Well A-2): Iron (2150 ug/L; SMCL = 300 ug/L);
Manganese (168 ug/L; SMCL=50 ug/L)
Sample 209537(Sun Bay Well A-1): Iron (1060 ug/L; SMCL = 300 ug/L);
Manganese (528 ug/L; SMCL=50 ug/L)

Table - 1
Potable Water Tanks Sampled on September 27, 1999

Name of Tank	Time sampled	Free Chlorine level	pH
Arcadia Tank	09:50 hours	1.81 mg/L	6.75 Standard Units
NASD (US Navy) Tank	11:15 hours	0.48 mg/L	7.08 Standard Units
Florida 1 Tank	13:20 hours	1.32 mg/L	6.80 Standard Units
Florida 2 Tank	13:33 hours	1.31 mg/L	6.83 Standard Units
Martineau Tank	14:10 hours	1.27 mg/L	6.89 Standard Units
Pilon Tank	14:45 hours	0.03 mg/L	7.17 Standard Units
Esperanza Tank	15:25 hours	1.05 mg/L	7.01 Standard Units
Destino Tank	15:58 hours	0.81 mg/L	7.02 Standard Units
Los Chivos Tank	16:35 hours	0.42 mg/L	7.27 Standard Units
Leguillow Tank	17:09 hours	0.20 mg/L	6.96 Standard Units

Table 2
Vieques, Puerto Rico
A Comparison of the Sampling Results

Parameter	Arcadia Tank	NASD (Navy) Tank	Florida 1 Tank	Florida 2 Tank	Martineau Tank
Aluminum (Al)	Undetected	Undetected	Undetected	Undetected	Undetected
Antimony (Sb)	Undetected	Undetected	Undetected	Undetected	Undetected
Arsenic (As)	Undetected	Undetected	Undetected	Undetected	Undetected
Boron (B)	14 ug/L	16 ug/L	13 ug/L	Undetected	Undetected
Barium (Ba)	Undetected	Undetected	Undetected	Undetected	Undetected
Beryllium (Be)	Undetected	Undetected	Undetected	Undetected	Undetected
Cadmium (Cd)	Undetected	Undetected	Undetected	Undetected	Undetected
Chromium (Cr)	Undetected	Undetected	Undetected	Undetected	Undetected
Copper (Cu)	Undetected	Undetected	Undetected	Undetected	Undetected
Iron (Fe)	Undetected	Undetected	Undetected	Undetected	Undetected
Lead (Pb)	Undetected	Undetected	Undetected	Undetected	Undetected
Mercury (Hg)	Undetected	Undetected	Undetected	Undetected	Undetected
Manganese (Mn)	8 ug/L	4 ug/L	6 ug/L	7 ug/L	5 ug/L
Molybdenum (Mo)	Undetected	Undetected	Undetected	Undetected	Undetected
Nickel (Ni)	Undetected	Undetected	Undetected	Undetected	Undetected
Sodium (Na)	8.8 mg/L	9.6 mg/L	8.8 mg/L	9.9 mg/L	8.9 mg/L
Selenium (Se)	Undetected	Undetected	Undetected	Undetected	Undetected
Thallium (Tl)	Undetected	Undetected	Undetected	Undetected	Undetected
Zinc (Zn)	Undetected	16 ug/L	Undetected	Undetected	11 ug/L
Chloride	20.1 mg/L	22.2 mg/L	21.4 mg/L	20.2 mg/L	21.2 mg/L
Cyanide (Total)	Undetected	Undetected	Undetected	Undetected	Undetected
Fluoride	Undetected	Undetected	Undetected	Undetected	Undetected
Sulfate	5.17 mg/L	6.00 mg/L	5.37 mg/L	5.05 mg/L	5.56 mg/L
Total Dissolved Solids	110 mg/L	99 mg/L	108 mg/L	101 mg/L	102 mg/L
Nitrate plus Nitrite	Undetected	0.14 mg/L	Undetected	Undetected	0.05 ug/L

Table 2 (continued)
Vieques, Puerto Rico
A Comparison of the Sampling Results

Parameter	Arcadia Tank	NASD (Navy) Tank	Florida 1 Tank	Florida 2 Tank	Martineau Tank
Volatile organic compounds					
- Chloroform	47 ug/L	57 ug/L	52 ug/L	44 ug/L	50 ug/L
- Dichlorobromomethane	11 ug/L	12 ug/L	13 ug/L	10 ug/L	14 ug/L
- 4-Methyl-2-pentanone	Undetected	3.3 ug/L	Undetected	Undetected	2.6 ug/L
- Toluene	Undetected	Undetected	Undetected	Undetected	Undetected
- Chlorodibromomethane	1.2 ug/L	2.1 ug/L	2.2 ug/L	1.4 ug/L	2.7 ug/L
Total Trihalomethanes	59 ug/L	71 ug/L	67 ug/L	56 ug/L	67 ug/L
Non-volatile organic compounds					
- Bis (2-Ethylhexyl) phthalate	Undetected	Undetected	No Data	10 ug/L	15 ug/L
Constituents of Military Ordnance - At this time preliminary data has been received that does not show the presence of these compounds. The final data package will be transmitted in the near future.					
HMX	Undetected	Undetected	Undetected	Undetected	Undetected
RDX	Undetected	Undetected	Undetected	Undetected	Undetected
1,3,5-TNB	Undetected	Undetected	Undetected	Undetected	Undetected
1,3-DNB	Undetected	Undetected	Undetected	Undetected	Undetected
Tetryl	Undetected	Undetected	Undetected	Undetected	Undetected
NB	Undetected	Undetected	Undetected	Undetected	Undetected
2,4,6-TNT	Undetected	Undetected	Undetected	Undetected	Undetected
4-Am-DNT	Undetected	Undetected	Undetected	Undetected	Undetected
2,6Am-DNT	Undetected	Undetected	Undetected	Undetected	Undetected
2,4-DNT	Undetected	Undetected	Undetected	Undetected	Undetected
2,6-DNT	Undetected	Undetected	Undetected	Undetected	Undetected
2-NT	Undetected	Undetected	Undetected	Undetected	Undetected
3-NT	Undetected	Undetected	Undetected	Undetected	Undetected
4-NT	Undetected	Undetected	Undetected	Undetected	Undetected

Table 2-A
Vieques, Puerto Rico
A Comparison of the Sampling Results

Parameter	Pilon Tank	Esperanza Tank	Destino Tank	Los Chivos Tank	Leguillow Tank
Aluminum (Al)	Undetected	Undetected	Undetected	Undetected	Undetected
Antimony (Sb)	Undetected	Undetected	Undetected	Undetected	Undetected
Arsenic (As)	Undetected	Undetected	Undetected	Undetected	Undetected
Boron (B)	15 ug/L	14 ug/L	14 ug/L	15 ug/L	15 ug/L
Barium (Ba)	Undetected	Undetected	Undetected	Undetected	Undetected
Beryllium (Be)	Undetected	Undetected	Undetected	Undetected	Undetected
Cadmium (Cd)	Undetected	Undetected	Undetected	Undetected	Undetected
Chromium (Cr)	Undetected	Undetected	Undetected	Undetected	Undetected
Copper (Cu)	13 ug/L	Undetected	Undetected	Undetected	Undetected
Iron (Fe)	113 ug/L	53 ug/L	75 ug/L	77 ug/L	Undetected
Lead (Pb)	Undetected	Undetected	Undetected	Undetected	Undetected
Mercury (Hg)	Undetected	Undetected	Undetected	Undetected	Undetected
Manganese (Mn)	3 ug/L	5 ug/L	6 ug/L	10 ug/L	2 ug/L
Molybdenum (Mo)	Undetected	Undetected	Undetected	Undetected	Undetected
Nickel (Ni)	Undetected	Undetected	Undetected	Undetected	Undetected
Sodium (Na)	9.5 mg/L	9.5 mg/L	9.3 mg/L	9.4 mg/L	9.1 mg/L
Selenium (Se)	Undetected	Undetected	Undetected	Undetected	Undetected
Thallium (Tl)	Undetected	Undetected	Undetected	Undetected	Undetected
Zinc (Zn)	9 ug/L	Undetected	Undetected	Undetected	Undetected
Chloride	24.4 mg/L	21.7 mg/L	22.4 mg/L	23.5 mg/L	23.4 mg/L
Cyanide (Total)	Undetected	Undetected	Undetected	Undetected	Undetected
Fluoride	Undetected	Undetected	Undetected	Undetected	Undetected
Sulfate	6.53 mg/L	5.72 mg/L	6.01 mg/L	6.33 mg/L	6.36 mg/L
Total Dissolved Solids	106 mg/L	87 mg/L	93 mg/L	105 mg/L	103 mg/L
Nitrate plus Nitrite	Undetected	0.12 mg/L	0.05 ug/L	0.05 ug/L	0.05ug/L

Table 2-A (continued)
Vieques, Puerto Rico
A Comparison of the Sampling Results

Parameter	Pilon Tank	Esperanza Tank	Destino Tank	Los Chivos Tank	Leguillow Tank
Volatile organic compounds					
- Chloroform	58 ug/L	48 ug/L	55 ug/L	60 ug/L	69 ug/L
- Dichlorobromomethane	11 ug/L	14 ug/L	12 ug/L	12 ug/L	13 ug/L
- 4-Methyl-2-pentanone	Undetected	Undetected	Undetected	Undetected	Undetected
- Toluene	Undetected	1.1 ug/L	Undetected	Undetected	Undetected
- Chlorodibromomethane	1.9 ug/L	2.8 ug/L	2.4 ug/L	2.1 ug/L	2.0 ug/L
Total Trihalomethanes	71 ug/L	65 ug/L	69 ug/L	74 ug/L	84 ug/L
Non-volatile organic compounds					
- Bis (2-Ethylhexyl) phthalate	Undetected	Undetected	No Data	Undetected	Undetected
Constituents of Military Ordnance - At this time preliminary data has been received that does not show the presence of these compounds. The final data package will be transmitted in the near future.					
HMX	Undetected	Undetected	Undetected	Undetected	Undetected
RDX	Undetected	Undetected	Undetected	Undetected	Undetected
1,3,5-TNB	Undetected	Undetected	Undetected	Undetected	Undetected
1,3-DNB	Undetected	Undetected	Undetected	Undetected	Undetected
Tetryl	Undetected	Undetected	Undetected	Undetected	Undetected
NB	Undetected	Undetected	Undetected	Undetected	Undetected
2,4,6-TNT	Undetected	Undetected	Undetected	Undetected	Undetected
4-Am-DNT	Undetected	Undetected	Undetected	Undetected	Undetected
2,6Am-DNT	Undetected	Undetected	Undetected	Undetected	Undetected
2,4-DNT	Undetected	Undetected	Undetected	Undetected	Undetected
2,6-DNT	Undetected	Undetected	Undetected	Undetected	Undetected
2-NT	Undetected	Undetected	Undetected	Undetected	Undetected
3-NT	Undetected	Undetected	Undetected	Undetected	Undetected
4-NT	Undetected	Undetected	Undetected	Undetected	Undetected

Table 3
Vieques, Puerto Rico
A Comparison of the Sampling Results

Parameter	Sun Bay Well A-3	Sun Bay Well A-2	Sun Bay Well A-1	Peterson's Well	Martineau Site Well
Aluminum (Al)	Undetected	Undetected	Undetected	Undetected	Undetected
Antimony (Sb)	Undetected	Undetected	Undetected	Undetected	Undetected
Arsenic (As)	Undetected	Undetected	Undetected	Undetected	Undetected
Boron (B)	203 ug/L	226 ug/L	213 ug/L	280 ug/L	264 ug/L
Barium (Ba)	Undetected	Undetected	Undetected	267 ug/L	Undetected
Beryllium (Be)	Undetected	Undetected	Undetected	Undetected	Undetected
Cadmium (Cd)	Undetected	Undetected	Undetected	Undetected	Undetected
Chromium (Cr)	Undetected	Undetected	Undetected	Undetected	Undetected
Copper (Cu)	Undetected	Undetected	Undetected	Undetected	Undetected
Iron (Fe)	**1,620 ug/L**	**2,150 ug/L**	**1,060 ug/L**	Undetected	Undetected
Lead (Pb)	Undetected	Undetected	Undetected	Undetected	Undetected
Mercury (Hg)	Undetected	Undetected	Undetected	Undetected	Undetected
Manganese (Mn)	115 ug/L	168 ug/L	528 ug/L	27 ug/L	25 ug/L
Molybdenum (Mo)	Undetected	Undetected	Undetected	Undetected	0.05 ug/L
Nickel (Ni)	Undetected	Undetected	Undetected	Undetected	Undetected
Sodium (Na)	103 mg/L	115 mg/L	120 mg/L	229 mg/L	172 mg/L
Selenium (Se)	Undetected	Undetected	Undetected	Undetected	Undetected
Thallium (Tl)	Undetected	Undetected	Undetected	Undetected	Undetected
Zinc (Zn)	24 ug/L	5 ug/L	6 ug/L	6 ug/L	14 ug/L
Chloride	78.0 mg/L	102 mg/L	99.1 mg/L	242 mg/L	202 mg/L
Cyanide (Total)	Undetected	Undetected	Undetected	Undetected	Undetected
Fluoride	Undetected	Undetected	Undetected	Undetected	Undetected
Sulfate	32.8 mg/L	36.6 mg/L	39.7 mg/L	62.4 mg/L	63.0 mg/L
Total Dissolved Solids	456 mg/L	90.5 mg/L	**1,670 mg/L**	**1,330 mg/L**	**1,220 mg/L**
Nitrate plus Nitrite	0.26 mg/L	1.86 mg/L	1.47 mg/L	**12.6 mg/L**	1.33 mg/L

Table 3 (continued)
Vieques, Puerto Rico
A Comparison of the Sampling Results

Parameter	Sun Bay Well A-3	Sun Bay Well A-2	Sun Bay Well A-1	Peterson's Well	Martineau Site Well
Volatile organic compounds	Undetected	Undetected	Undetected	Undetected	Undetected
Total Trihalomethanes	Undetected	Undetected	Undetected	Undetected	Undetected
Non-volatile organic compounds - Bis (2-Ethylhexyl) phthalate	Undetected	Undetected	Undetected	22 ug/L	Undetected
Constituents of Military Ordnance - At this time preliminary data has been received that does not show the presence of these compounds. The final data package will be transmitted in the near future.					
HMX	Undetected	Undetected	Undetected	Undetected	Undetected
RDX	Undetected	Undetected	Undetected	Undetected	Undetected
1,3,5-TNB	Undetected	Undetected	Undetected	Undetected	Undetected
1,3-DNB	Undetected	Undetected	Undetected	Undetected	Undetected
Tetryl	Undetected	Undetected	Undetected	Undetected	Undetected
NB	Undetected	Undetected	Undetected	Undetected	Undetected
2,4,6-TNT	Undetected	Undetected	Undetected	Undetected	Undetected
4-Am-DNT	Undetected	Undetected	Undetected	Undetected	Undetected
2,6Am-DNT	Undetected	Undetected	Undetected	Undetected	Undetected
2,4-DNT	Undetected	Undetected	Undetected	Undetected	Undetected
2,6-DNT	Undetected	Undetected	Undetected	Undetected	Undetected
2-NT	Undetected	Undetected	Undetected	Undetected	Undetected
3-NT	Undetected	Undetected	Undetected	Undetected	Undetected
4-NT	Undetected	Undetected	Undetected	Undetected	Undetected

Chemistry Case Narrative
Project 165: Vieques Project

Sixteen aqueous samples were received for VOA analysis and fifteen aqueous samples were received for NVOA, Metals, Nitrate-Nitrite, Cyanide, Fluoride, Chloride, Sulfate, and Total Dissolved Solids analysis. One of the samples for NVOA analysis, sample 209527, arrived at the laboratory broken.

All analysis were conducted in accordance with the methods listed in the QA Project Plan. Any deviations or anomalies are listed below under the appropriate analysis group.

Any samples that contained levels above the MCL or SMCL (inorganic contaminants only) are noted below under the appropriate analysis group. This interpretation, however, should not preclude a review of compliance with the MCLs by the appropriate EPA drinking water program staff.

Volatile Organic Analytes (VOAs):

The samples collected for VOAs were dechlorinated with sodium thiosulfate and maintained at 4°C until arrival, in accordance with the procedures listed in the QA Project Plan. The samples were not preserved to pH<2 with HCl acid to avoid analytical interferences observed when HCl is combined with sodium thiosulfate (this was a laboratory policy dating back several years). When acid is not added, the holding time is seven days for most programs, i.e., CERCLA, NPDES, and RCRA and 24 hours for the SDWA program, except for Trihalomethanes (THMs), which is fourteen days.

Due to the logistics involved with this project, analysis of the VOAs within 24 hours was not feasible. All samples were analyzed within seven days of sample collection, in accordance with the procedures listed in the QA Project Plan. The holding time was exceeded for all VOA analysis, except for THMs, which were analyzed within the holding time.

Non-Volatile Organic Analytes (NVOAs):

Sample 209532 (1-liter jar) was broken during transport from the receiving station to the refrigerator. The NVOA results are coded with an "O" to indicate "laboratory accident".

MCL Exceedences:

Sample 209528: Bis (2-ethylhexyl) phthalate (10 ug/L; MCL = 6 ug/L)
Sample 209529: Bis (2-ethylhexyl) phthalate (15 ug/L; MCL = 6 ug/L)
Sample 209538: Bis (2-ethylhexyl) phthalate (22 ug/L; MCL = 6 ug/L)

Note - The Bis (2-ethylhexyl) phthalate exceedences are most likely due to contamination of the sample introduced during the collection and analysis of the samples.

Metals:

MCL/SMCL Exceedences:

Sample 209535: Iron (1620 ug/L;SMCL=300 ug/L); Manganese (115 ug/L;SMCL=50 ug/L)
Sample 209536: Iron (2150 ug/L; SMCL = 300 ug/L); Manganese (168 ug/L; SMCL=50 ug/L)
Sample 209537: Iron (1060 ug/L; SMCL = 300 ug/L); Manganese (528 ug/L; SMCL=50 ug/L)

Sanitary Analytes:

MCL/SMCL Exceedences:

Sample 209537: TDS (1670 mg/L;SMCL=500 mg/L)
Sample 209538: TDS (1330 mg/L;SMCL=500 mg/L); Nitrate/Nitrite (12.6 mg/L;MCL=10 mg/L)
Sample 209539: TDS (1220 mg/L;SMCL = 500 mg/L)

APPENDIX D

Work Plan Checklists

APPENDIX D. Work Plan Checklists

Site-Specific Investigation-Derived Waste Plan Checklist

This checklist supplements the Master IDW Plan with site-specific information. Once completed for a specific project, it provides necessary IDW information for each investigation. It is to be taken into the field with the Master IDW Plan.

Site: AFWTF

1. IDW Media:
   - X_____Soil cuttings
   - X_____Well development or purge water
   - X_____Decontamination residual soil and wastewater
   - X_____PPE or disposable equipment
   - _____Other _____

2. Expected Regulatory Status:
   - _____Hazardous
   - _____Solid Waste
   - X_____Unknown
   - X_____Other Waste management activities regulated by OSHA Hazwoper standard (1910.120)

3. Site Location: Decontamination fluids and PPE will be generated at all SWMUs.

4. Nature of Contaminants Expected:
   - X_____Petroleum contamination
   - X_____Polyaromatic hydrocarbon
   - X_____Pesticides
   - X_____Herbicides
   - X_____PCBs
   - X_____Metals
   - X_____Other - Contaminant concentrations from previous analytical results were very low for all of the above.

5. Volume of IDW Expected:
   - X_____Drums - Maximum of 4. One for each well.
   - _____Cubic Yards
   - _____Tons
   - _____Gallons

6. Compositing Strategy for Sample Collection: No IDW sampling planned. Will base disposal decisions on analytical results from sampling.

7. IDW Storage

X_____As per Master IDW Plan _____Other_____

8. Waste Disposal

X_____As per Master IDW Plan _____Other_____

Site-Specific Quality Assurance Project Plan Checklist

This checklist supplements the Master QAPP with site-specific information. Once completed for a specific project, it provides necessary quality assurance information for each investigation. It is to be taken into the field with the Master QAPP.

Site: AFWTF

1. List sampling tasks: groundwater and subsurface soil sampling, surface soil sampling, and monitoring well installations.

2. List data quality objectives: The objective of the SWMU Investigation is to determine the need for further action at each of the SWMUs. Previous analytical data and the analytical data generated from the Investigation will be reviewed and a recommendation for no further action or additional investigation will be made based on the data.

3. Organization:

LANTDIV Navy Technical Representative	Chris Penny/LANTDIV
PREQB Federal Facilities Project Manager	Aissa Colon/PREQB
CH2M HILL Activity Manager	John Tomik/CH2M HILL
Quality Control Senior Review	Kevin Sanders/CH2M HILL
Technical Project Manager	Marty Clasen/CH2M HILL
Field Team Leader	Erik Isern/CH2M HILL

4. Table of samples with analyses to be performed and associated QC samples included in the SWMU Investigation Work Plan.

5. Analytical Quantitation Limits:
   X_____As per Master QAPP

   _____Other

6. QA/QC Acceptance Criteria (e.g., precision, accuracy)

   X_____As per Master QAPP _____Other (attached)

7. Data reduction, validation, and reporting:

   X_____As per Master QAPP _____Other (attached)

8. Internal QC Procedures (field and laboratory):

   X_____As per Master QAPP _____Other (attached)

9. Corrective Action:

   X_____As per Master QAPP _____Other (attached)

10. Other deviations from Master QAPP - None

Site-Specific Field Sampling Plan Checklist

This checklist supplements the Master Field Sampling Plan with site-specific information. Once completed for a specific project, it provides necessary field sampling information for each investigation. It is to be taken into the field with the Master FSP.

Site: AFWTF

1. Tasks to be performed:

_____Geophysical surveys	_____Aquifer testing
_____Soil gas surveys	X_____Hydrogeologic measurements
_____Surface water and sediment sampling	_____Biota sampling
_____Surface soil sampling	_____Trenching
_____Soil boring installation	_____Land surveying
_____Subsurface soil sampling	X_____Investigation derived waste sampling
_____Monitoring well installation and development	X_____Decontamination
_____Monitoring well abandonment	_____Other_____
X_____Groundwater sampling	_____
X_____In-situ groundwater sampling	

2. Field measurements to be taken:

X_____temperature	_____surveying
X_____pH	_____magnetometry
_____dissolved oxygen	_____global positioning system
X_____turbidity	_____soil gas parameters (list):
X_____specific conductance	_____combustible gases
X_____organic vapor monitoring	X_____water-level measurements
_____geophysical parameters (list):	_____pumping rate
_____electromagnetic induction	_____other_____
_____ground-penetrating radar	_____

3. Sampling program (nomenclature, etc.):

_____As per Master FSP X_____Other As presented in the PA/SI Investigation Work Plan

4. Map of boring and sampling locations (attach to checklist): See Work Plan.
5. Table of field samples to be collected: See Investigation Work Plan.
6. Applicable SOPs or references to specific pages in Master FSP: The following SOPs from Volume 2 of the Master Project Plans are to be implemented.

- VOC Sampling – Water
- Field Filtering
- Chain-of-Custody
- Packaging and Shipping Procedures
- Field Rinse Blank Preparation
- Decontamination of Personnel and Equipment
- Disposal of Fluids

7. Site-specific procedures or updates to protocols established in the Master FSP:

   Described in the Work Plan.

Site-Specific Health and Safety Plan

This checklist must be used in conjunction with the Master HASP. This checklist is intended for use by CH2M HILL employees only. All CH2M HILL employees performing tasks under this checklist must read and sign both this checklist and the Master HASP and agree to abide by their provisions (see EMPLOYEE SIGNOFF attached to the checklist.

Site: AFWTF

Location(s) SWMU Location Map and Individual SWMU figures are included in the Work Plan.

This document shall be maintained on site with the Master Health and Safety Plan. It will include as attachments from the Work Plan a site map and the site characterization and objectives for this site.

The procedures described in the Master Health and Safety Plan will be followed unless otherwise specified in this Site-Specific Health and Safety Plan.

1. HAZWOPER-Regulated Tasks

_____Test pit and excavation
_____Soil boring installation
_____Geoprobe boring
_____Geophysical surveys
_____Hand augering
_____Subsurface soil sampling
_____Surface soil sampling
_____Soil gas surveys
_____Sediment sampling
_____Monitoring well/drive point installation
_____Monitoring well abandonment
X_____Groundwater sampling
_____Aquifer testing
X_____Hydrologic measurements
_____Surface water sampling
_____Biota sampling
X_____Investigation-derived waste (drum) sampling and disposal
_____Observation of loading of material for offsite disposal
_____Oversight of remediation and construction
_____Other_____

2. Hazards of Concern: (Check as many as are applicable. Refer to Section 3 of Master H&S Plan for control measures):

X_____Heat stress
_____Cold stress
_____Buried utilities, drums, tanks
_____Inadequate illumination
X_____Drilling
_____Heavy equipment
_____Working near water
_____Flying debris
_____Gas cylinders
X_____Noise
X_____Slip, trip, or fall hazards
X_____Back injury
_____Confined space entry
_____Trenches, excavations
_____Protruding objects
X_____Vehicle traffic
_____Ladders, scaffolds
_____Fire
_____Working on water
_____Snakes or insects
X_____Poison ivy, oak, sumac
X_____Ticks
_____Radiological
_____Other_____

3. Contaminants of Concern (List if known. Refer to Table 3.8 of the Master HASP contaminant-specific information

PCBs Metals VOCs

PNAs SVOCs

4. Personnel (List CH2M HILL field team members:

Field team leader(s) Erik Isern

Site safety coordinator(s) Erik Isern

Field team members Karen Karvazy, Emiliano Cabale, Héctor Hernández, Gabe Silva

5. Contractors/Subcontractor

X Procedures as per Master HASP

X Other

Name: To be added _____ _____

Contact: To be added _____ _____

Telephone: To be added _____

6. Level of personal protective equipment (PPE) required: D
Refer to Table 5.1 of Master HASP, CH2M HILL SOPs HS-07 and HS-08, and Respiratory Protection, Section 2 of the Site Safety Notebook.

7. Air monitoring instruments to be used (refer to Master HSP for action levels):

X OVM 10.6 _____ FID

_____ CGI _____ Dust monitor

_____ O_2

8. Decontamination procedures:

_____ As per Section 7 of Master HASP

X Other As described in the SWMU Investigation Work Plan.

9. List any other deviations or variations from the Master HASP: None

10. Emergency Response (Check that all names and numbers are correct on page 47 of Master HASP and attach corrected page to this checklist)

11. Map to hospital (Highlight route to hospital from site and attach to this checklist)

12. Emergency Contacts (Check that all names and numbers are correct on page 49 of Master HASP and attach corrected page to this checklist)

13. Approval. This prepared site-specific checklist must be approved by John Longo/NJO or Laura Johnson/NJO or their authorized representative

    Name _____Title: Health and Safety Manager Date: _____

    (Signature will be included in the Final HASP)

14. Employee Signoff. All CH2M HILL employees working at the site must sign the attached Employee Signoff for the checklist as well as for the Master HASP.

    _____Site

HASP Checklist Employee Signoff

The employees listed below have been given a copy of both this health and safety plan checklist and the Master HSP, have read and understood them, and agree to abide by their provisions.

EMPLOYEE NAME	EMPLOYEE SIGNATURE AND DATE